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NOISE MEASUREMENTS

SECOND INTERIM REPORT
1974 - 1975

by

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16. Abstract

Noise Measurements for 24-hour periods were made at various microphone positions at six sites adjacent to existing roadways. Traffic volume and speed measurements were made simultaneously with noise measurements. The noise measurement sites were surveyed using standard surveying techniques to determine distances and elevations, relative to the roadway, of microphone positions and noise barriers for input into the Michigan Traffic Noise Prediction Program and the Transportation Systems Center Traffic Noise Prediction Program. Noise level predictions were made for each site using the two prediction programs. The measured and predicted noise levels were statistically compared to determine the accuracy of the programs. A method to produce corrections to predicted levels was developed and corrections for the six noise measurement sites were determined.

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The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of data presented herein. The contents do not necessarily reflect the official views or policy of the State or Federal Department of Transportation. This report does not constitute a standard, specification or regulation.

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Preface

In recent years there has been increasing concern on the part of the public regarding high noise levels by individual motor vehicles and the collective noise from highway traffic. In order to better understand the generation and propagation of traffic noise in the vicinity of highway facilities, a data bank of noise levels for various types of highway configurations is needed. The New Jersey Department of Transportation in cooperation with the Federal Highway Administration began Project 7787 - Noise Measurements to obtain this data bank of noise levels.

The project objectives as stated in the original work plan of January 15, 1971 are as follows:

The specific aim is to establish the current levels of noise adjacent to typical roads in order to detect future changes in noise levels. Sound surveys will be conducted along 1) existing roads, 2) proposed right-of-ways, prior to construction, 3) roads after construction and prior to opening for traffic, and 4) roads after construction and after opening for traffic and after improvements or alterations.

Traffic noise will also be measured as a function of traffic density composition, distance from road, and vehicle speed.

To accomplish the above objectives sound surveys were made at twelve sites representing 1, 2,and 3 above during 1972 and 1973. The measurements at these sites represent "before" measurements and the results of the measurements were reported in "Noise Measurements-First Interim Report", 1972-1973. "After" measurements were to be made in the future when roadways were constructed and opened for traffic.

Additional project objectives as stated in the supplement to the work plan, June 14, 1971 are as follows:

Increased emphasis will be made in selecting and measuring existing sites and noise problem areas on various types of highways. In the analysis of data an attempt will be made to isolate the causes of high noise levels at existing problem areas and to isolate the causes for changes in noise levels in before and after situations. Where possible, recommendations will be made concerning corrective measures in existing problem area and possible noise preventive measures that may be considered for new designs.

In June, 1971 when the above additional objectives were written, there was very little control over noise generated by highways, and no definition of problem areas existed. In April 1972 the Federal Highway Administration Policy and Procedure Memorandum 90-2 (PPM 90-2) established noise standards for highways and defined noise problem areas. PPM 90-2 also provided a procedure for which each problem area could be considerdd. Applying PPM 90-2 to New Jersey it can be seen that there are not just a few problem areas but rather many problem areas throughout the state, and each must be considered separately as set forth in PPM 90-2.

After discussion with the Federal Highway Administration it was then decided that while waiting for roadways to be constructed and opened for traffic that the project objectives would be expanded. The new project objectives included measurement of noise levels at locations with variations in traffic, roadway, and topographical parameters and comparison of these noise levels with theoretical predictions utilizing the Michigan Traffic Noise Prediction Program (Michigan Program) and the Transportation Systems Center Traffic Noise Prediction Program (TSC Program).

1. Introduction

This Second Interim Report contains results of work done during fiscal years 1974 and 1975 to compare predicted and measured noise levels adjacent to existing roadways. The following major work tasks were undertaken.

1. Select six noise measurement sites adjacent to existing roadways.

2. Conduct twenty-four hour noise surveys at the chosen sites. The noise surveys shall include the collection of traffic data.

3. Analyze the data taken at the selected sites to determine the L_{10}, L_{50}, L_{90}, L_{NP}, and standard deviation.

4. Predict noise for the selected sites using the Michigan Program and the TSC Program.

5. Statistically compare the measured and predicted noise levels to determine differences between these levels and to determine a method to produce corrections for the predicted results.

The undertaking of the above work tasks resulted in the following accomplishments.

1. The following six noise measurement sites were selected.
   a) Route 29, Section 13A (Residential)
   b) Route 29, Section 13A (Stacy Park)
   c) Route I-78, Section 2G (Clinton)
   d) Route I-78, Section 2M & 3E (Annandale)
   e) Route I-287, Section 1E, 4B & 5B (Bridgewater)
   f) Route I-80, Section 1B & 2L (Netcong)

2. Noise levels were tape recorded and analyzed at various positions at each site. Traffic data was simultaneously recorded.

3. The sites were surveyed using standard surveying techniques to determine distances and elevations, relative to the roadway, of microphone positions and barriers for input into the prediction programs.

4. Noise level predictions were made for each site using the Michigan program and the TSC program.

5. The measured and predicted noise levels were statistically compared to determine the accuracy of the programs. To accomplish this, the Annandale and Netcong sites were divided into subsites which were considered as sites for the statistical analysis. Thus comparisons of noise levels were made for the following nine sites.

a) Route 29, Section 13A (Residential)

b) Route 29, Section 13A (Stacy Park)

c) Route I-78, Section 2G (Clinton)

d) Route I-78, Section 2M & 3E (Annandale) microphone positions 1, 2, 3 and 4

e) Route I-78, Section 2M & 3E (Annandale) microphone positions 5, 6, 7 and 8

f) Route I-78, Section 2M & 3E (Annandale) microphone positions 9, 10, 11 and 12

g) Route I-287, Section 1E, 4B & 5B (Bridgewater)

h) Route I-80, Section 1B & 2L (Netcong) microphone positions 1, 2 and 4

i) Route I-80, Section 1B & 2L (Netcong) microphone positions 5 and 8

6. A method to produce corrections to predicted levels was developed and corrections for the above sites were determined.

2. Conclusions

There were significant differences between observed and predicted L_{10} noise levels at all sites except Route 29, Section 13A (Residential) and Route I-80, Section 1B and 2L (Netcong) microphone positions 1, 2 and 4. The TSC program predicted on the average from approximately 2 dB to 9 dB above observed levels at these sites. The Michigan program based on NCHRP Reports 117 and 144, predicted on the average from approximately 6 dB below to 4 dB above observed levels at these same sites.

The TSC program shows a general tendency to overpredict observed noise levels. Statistical analysis on differences shows that this is caused by the inability to adequately specify the attenuation with distance, by taking into consideration the attenuation of intervening terrain. In addition, the TSC program approximates all barriers with knife-edges. This approximation seems to work well on such a barrier. However, when applied to an extended earth mound barrier, further overprediction may result. The overprediction is also related to the high average truck noise emission level applied by the program to all trucks equally. This one level is not appropriate for the truck traffic mixes generally encountered on the highway. Furthermore, the assumption of a line source for truck distribution along the highway might be inadequate. The actual truck traffic might be better represented more like a point source distribution that has greater attenuation with distance.

The Michigan program, within the stated range, shows a general tendency to underpredict observed noise levels from roadways. Statistical analysis on differences shows that this characteristic is due to the program's

assumption of lower average truck noise emission levels than is appropriate for all truck traffic mixes generally encountered on the highway and greater attenuation with distance than is applicable to all types of intervening terrain. A counter tendency in the Michigan program is to overpredict noise levels affected by extended earth mound barriers. This is due to the approximation of all barriers by a knife-edge--the same approximation the TSC program uses. However, the greater assumed attenuation with distance for the Michigan program seems to compensate somewhat for this overprediction. The Michigan program also shows a counter tendency to overpredict for low truck volumes above a certain cutoff, which varies with distance from the roadway. However, the program follows the general trend of underprediction at positions close by the roadway for greater truck volumes, unaffected by barriers.

Investigations were also made on the data by linear regression between predicted and observed levels and between levels predicted by the two programs. The ideal straight line relationship of unit slope and zero intercept with high correlation and little scatter was sought.

Comparing predicted to observed levels for both programs, the ideal relationship was not found at all. Even an overall constant offset of predicted from observed levels was not found from linear regression at any of the sites for either program except at I-78, Section 2G (Clinton) for the TSC program. The regressions of predicted versus observed levels generally showed a fair amount of scatter with just fair correlation, expecially when depressions, elevations, barriers and terrain in the sound propagation path influenced the prediction.

The two programs when compared to one another, were found to produce noise levels highly consistent with each other for the same roadway input. That is, the regressions between the two program's levels generally had very little scatter and high correlation. The actual differences between absolute levels of the two programs were found to be significantly different nonetheless. Neither did the regressions demonstrate the ideal relationship nor a constant offset between levels.

3. Recommendations

Two factors were found to influence the deviation of program predictions from observed levels. They were distance from the observer to the roadway and truck volume. The distance factor relates to the terrain and barriers in the propagation path. The truck volume factor relates to the distribution of types of trucks and their noise emission levels.

Based on the conclusions it is recommended that the prediction methods be modified:

1. A distinction should be established between heavy tractor trailers and medium trucks with different noise emission levels in the inputs of the programs.

2. Distance attenuation should be a function of terrain in the programs and chosen by either the program or the user.

3. Earth mound barriers should be approximated by more complex structures than knife-edges. Barrier thickness should be considered.

Until such time that the prediction methods are modified, it is recommended that the results of the prediction methods be "corrected" by means of the input variables. This was the approach of the Kentucky Department of Transportation in reference 6. In that report simple regression was used to determine significant variables; one variable at a time was regressed on differences between observed and predicted levels. In this report step-wise regression is used to determine significant variables. Step-wise regression is a method which separates the effect of many variables and generates a multiple regression equation on differences between observed and predicted levels.

The multiple regression equations can be applied to obtain the differences between measured and predicted levels by means of significant input variables. Then the differences can be added to the predicted levels to obtain corrected levels.

It is further recommended that:

1. New Jersey apply the prediction methods and correction equations which are indicated for the sites below to similar sites where predictions are required.

   a) Route 29, Section 13A (Residential) - TSC program without correction

   b) Route 29, Section 13A (Stacy Park) - TSC program with correction equation

   c) Route I-78, Section 2G (Clinton) - No recommendation

   d) Route I-78, Section 2M & 3E (Annandale) microphone positions 1, 2, 3 and 4 - TSC program without correction

   e) Route I-78, Section 2M & 3E (Annandale) microphone positions 5, 6, 7 and 8 - Michigan program with correction equation

   f) Route I-78, Section 2M & 3E (Annandale) microphone positions 9, 10, 11 and 12 - TSC program with correction equation

   g) Route I-287, Section 1E, 4B & 5B (Bridgewater) - Michigan program with correction equation

   h) Route I-80, Section 1B & 2L (Netcong) microphone positions 1, 2 and 4 - TSC program without correction

   i) Route I-80, Section 1B & 2L (Netcong) microphone positions 5 and 8 - TSC program without correction

2. New Jersey and other states which have the means of implementation use the method of obtaining correction equations for sites where noise predictions are required, which are not similar to the sites in this report.

A general catalogue of sites with correction equations could be compiled as needed. The method of applying step-wise regression to differences between measured and predicted levels at a site would be used. The catalogue could constitute a data base from which correction equations for other similar sites are drawn.

4. Description of Noise Sites

The following sites were selected for noise surveys:

Route 29, Section 13A (Residential)

Route 29, Section 13A (Stacy Park)

Route I-78, Section 2G (Clinton)

Route I-78, Section 2M & 3E (Annandale)

Route I-287, Section 1E, 4B & 5B (Bridgewater)

Route I-80, Section 1B & 2L (Netcong)

Complete site descriptions together with maps are in Appendix A, where location of noise sites, sound propagation path characteristics, road description and microphone positions are listed.

Route 29, Section 13A (Residential)

This is a site within a residential community adjacent to metropolitan Trenton. Route 29 is the major noise generator for the site. Its traffic noise is attenuated to the microphone by two rows of two and three story residential dwellings. Two microphones were located 430 feet from the roadway edge. The height of the first microphone was five feet above ground and the other twelve feet above ground. No other major noise sources were present in the vicinity except light local traffic.

Route 29, Section 13A (Stacy Park)

This site is a typical metropolitan park, an open area with occasional trees. The terrain slopes down from Route 29, the major noise generator, toward the Delaware River with approximately a 4% grade. Three microphones were located at this site. Microphones Nos. 1 and 2 were located 75 feet from the roadway. The height of microphone No. 1 was five feet above ground, and microphone No. 2, twelve feet above ground. Microphone No. 3 was 150 feet from the roadway and its height was five feet above ground.

Route I-78, Section 2G (Clinton)

This site is west of Clinton on Route I-78 in a rural area. The major noise generator, I-78, is partially depressed at this site. The terrain is grassland with rolling hills. Microphones Nos. 1, 2, 3 and 4 were placed at 100, 200,400 and 800 feet respectively from the edge of the roadway five feet above the ground.

Route I-78, Section 2M & 3E (Annandale)

This site is located east of Annandale on Route I-78 in a rural area. The terrain is rolling grass. At this site, the west portion is an elevated highway configuration; and the east side, depressed. The central portion is a transition between the elevated and depressed configurations. Four noise surveys were made at this site with four ranks of microphones. Each rank was measured separately and placed parrallel to the roadway approximately 100, 200, 400 and 800 feet respectively from the edge of the road five feet above the ground.

Route I-287, Section 1E, 4B & 5B (Bridgewater)

This site is located in the vicinity of the intersection of Routes 22, 206 and I-287. The microphones were located adjacent to the parking lot of the Bridgewater-Raritan High School East, a noise sensitive area. The microphones were located five feet above the ground 100, 200 and 400 feet from the edge of Route I-287, northbound, the major noise generator. A dense growth of deciduous trees (15 to 20 feet high) and brush are located east of the line of microphones. Some traffic noise from the adjacent parking lot was present during the noise survey.

Route I-80, Section 1B & 2L (Netcong)

This site is an interchange of two highways--Route I-80 and Route 206. It is located just east of Netcong. Traffic noise from I-80 became the major noise source for micorphone positions 1, 2, 3 and 4. For microphone positions 5, 6, 7 and 8, the noise contribution from Route 206 was of primary importance. To describe the noise from the complex interchange, the microphones were placed in a pattern that would respond to the different noise conditions. Minor noise sources include traffic noise from the two ramps connecting Route I-80 and Route 206. Woods and brush provided significant attenuation of traffic noise in the area.

5. Data Acquisition

5.1 Data Gathering

Twenty-four hour noise surveys were conducted at the six sites. At Annandale, for microphone positions 1, 5 and 9, noise measurements were made for more than 24 consecutive hours. The minimum sampling time during each hour for all sites was 40 minutes with some exceptions. All samples at Netcong were 30 minutes. Shorter samples or missing samples were caused by equipment malfunctions and bad weather conditions such as high winds or rain. The basic field measurement procedures and noise sampling schemes followed were those discussed in "Noise Measurements, First Interim Report," Reference 7.

A typical arrangement of field recording instrumentation is shown in Figure 1 (page 15). Microphones were set at pre-determined positions and connected by cables to the recording system. The signal was A-weighted and amplified by the sound level meters and then tape recorded. The tape was later analyzed in the laboratory. In some instances the output from one of the sound level meters was not recorded on tape but routed directly to the graphic level recorder and statistical distribution analyzer for immediate analysis in the field.

For microphone positions greater than 300 feet from the tape recorder, the B & K 141-B field microphone system was used in place of the Sound Level Meter. This is a portable unit which consists of a tripod microphone, a preamplifier permanently attached to a 10-foot 7-conductor cable, and a waterproof box which houses essentially a battery operated sound level meter. This system may be placed a few thousand feet from the tape recorder allowing for much greater flexibility in microphone positioning. Field recording instrumentation was described in detail in "Noise Measurements, First Interim Report", Reference 7.

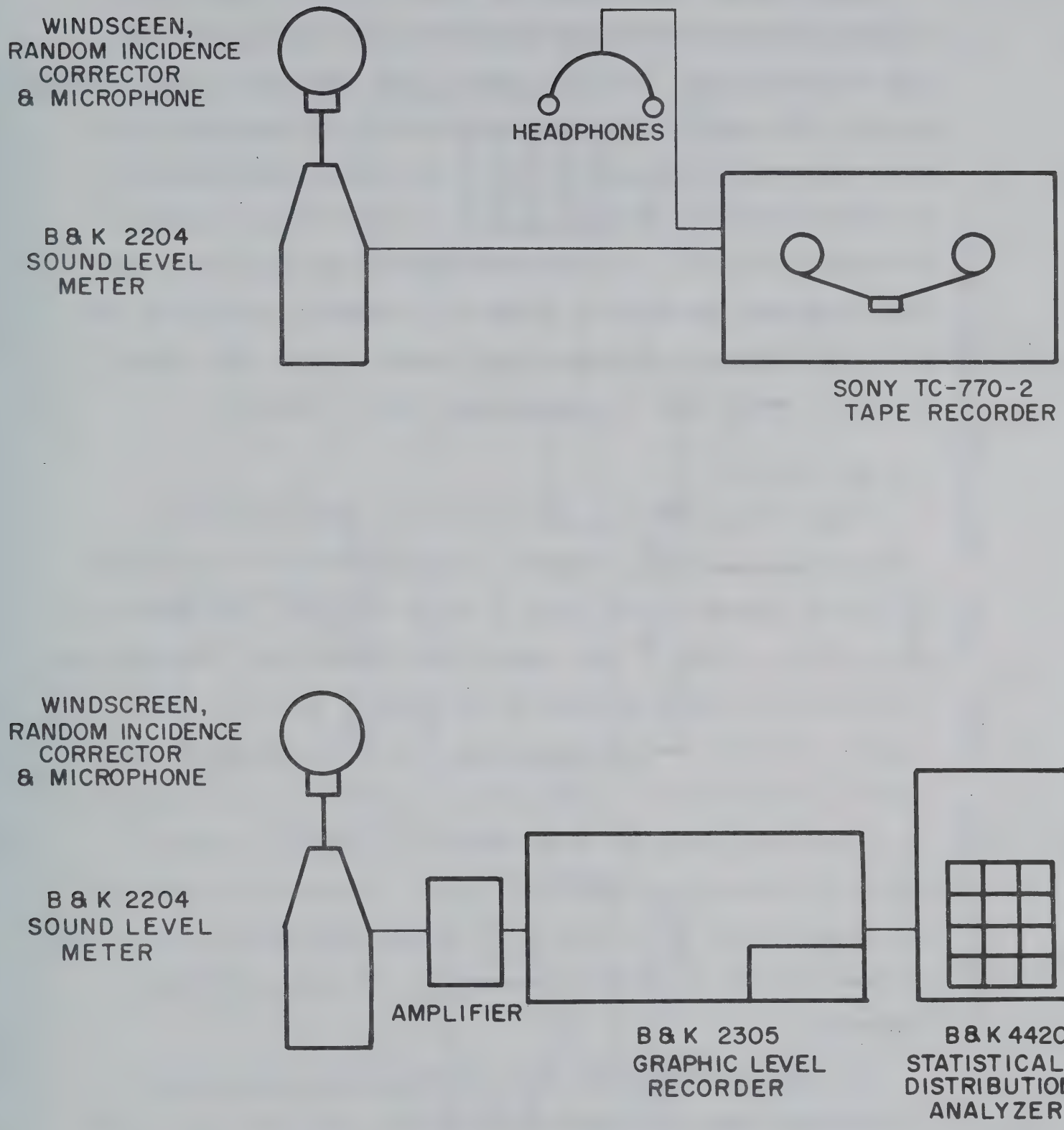


Figure 1

FIELD RECORDING INSTRUMENTATION

In addition to recording traffic noise, wind speed, wind direction and temperature measurements were recorded for each hour and notes were kept on precipitation. Classified traffic counts consisting of cars and trucks -- vehicles with a gross vehicle weight over 10,000 pounds--were made during noise measurements using automatic traffic counters and hand counters. When additional personnel became available and expertise was acquired in the operation of a radar unit, speed measurements were also taken. Speed measurements were made during a portion of the Annandale noise survey and all of the Bridgewater and Netcong noise surveys. Traffic data reduced by hour and weather data for each site are listed in Appendix A.

5.2 Data Analysis

Figure 2, (page 17) is a block diagram of a typical laboratory analyzing instrumentation arrangement. The recorded tape is played back on the tape recorder and the signal is fed to the graphic level recorder which produces a graph of sound pressure level versus time. The statistical distribution analyzer is connected to the stylus of the graphic level recorder and divides the amplitude of the noise level into twelve class intervals, ten intervals of 5 dBA each, one overshoot and one undershoot for noise levels outside the 50 dBA range, thus producing statistical data which is used to calculate noise levels. The amplifier is used for monitoring the tape during analysis. A complete description of the analysis equipment is given in the "Noise Measurements, First Interim Report," Reference 7.

The noise sample data were then transferred onto coding sheets in a standard format and keypunched on computer cards which serve as the

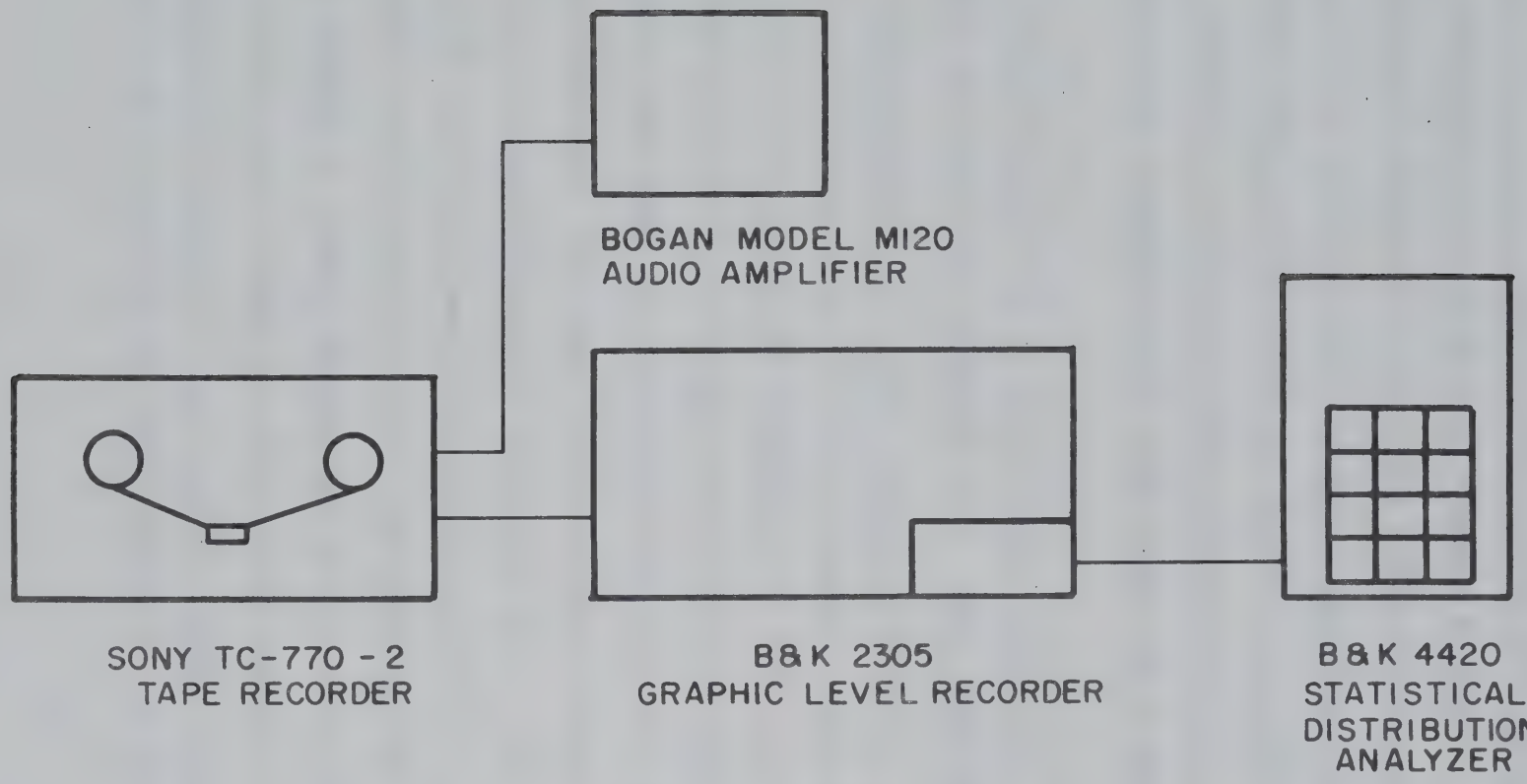


Figure 2

LABORATORY ANALYSIS INSTRUMENTATION

input medium for the computer program. The New Jersey Department of Transportation computer (IBM 370/145) was programmed to calculate the following quantities, from the input noise data:

L_{10} (dBA) -- The sound pressure level in decibels, A-weighted, exceeded 10 percent of the sample time. This represents the average peak level of the noise sample and is the descriptor of noise in Policy and Procedure Memorandum 90-2 issued by the Federal Highway Administration.

L_{50} (dBA) -- The sound pressure level in decibels, A-weighted, exceeded 50 percent of the sample time. This represents the average noise level.

L_{90} (dBA) -- The sound pressure level in decibels, A-weighted exceeded 90 percent of the sample time. This represents the background noise level.

L_{NP} (dBA) -- The noise pollution level, is a rating procedure representative of the level of annoyance from flunctuating noises, based on the assumption that public dissatisfaction depends on two factors -- the mean energy of imposed noise and the range of the variation of the levels. Numerically, the noise pollution level equals the mean energy level plus 2.56 times the standard deviation of the sound level around the mean.

Std. Dev. (dBA) -- The statistical standard deviation of the noise sample frequency distribution, which can be constructed from the cumulative distribution. This represents the variation in noise levels of the sample.

The resulting printout from the computer appears in Appendix A. Listed for each microphone position are the sampling time period in minutes, the hour and date of sample, the L_{10}, L_{50}, L_{90}, L_{NP} and the standard deviation at every hour in sequence from the beginning of the survey to

the end, during which noise measurements were made. All levels are given to the nearest one tenth of one decibel. Some hours were missed during the surveys so no noise data can be given for them. For these hours then the problem accounting for the omission was duly noted. The problems are categorized as due to microphone malfunction, equipment problems, operator error, bad weather conditions, or nonrepresentative noise.

Close inspection of the noise levels in Appendix A reveals that at Route 78, Section 2G (Clinton), inconsistencies between noise levels and traffic volumes appear throughout the measurement period. The data indicate higher noise levels at hours with small truck volumes than at hours with large truck volumes. The cause of these inconsistencies may be due to noise non-representative of traffic noise at the measurement sites since the inconsistencies appear at all microphone positions at the site.

6. Prediction of Noise Levels

6.1 Preparation

Roadway geometry, traffic, barrier, and receiver data was assembled for prediction of noise levels. The data was put into forms compatible for input to the TSC and the Michigan traffic noise prediction programs.

The sources of geometry data for prediction purposes were highway plans, cross-sections and profiles, and field surveying using standard techniques with rod, tape, and transit. The geometry was defined by points and straight line segments. The roadway centerline in each direction, and cuts and fills acting as barriers, were defined by points on the plans, so that intermediate points could be approximated by linear interpolation. Microphone positions were also surveyed.

Points were first referenced to the baseline of the plans by station and elevation, then converted to three-dimensional rectangular coordinates. The coordinate grid chosen for a site depended on ease of use. The X-Y coordinates were the New Jersey Plane Coordinate System, when the grid was superimposed on the plans. Where this grid was not available, an arbitrary X-Y grid, conveniently fixed to the roadway was used. The Z coordinate was always the elevation referenced to a datum line.

The geometry data used for prediction is presented graphically on a map grid for each site in Appendix B. Points on the X-Y plane are plotted with elevations noted. Lines are drawn between points and annotated to indicate roadway centerlines and barrier ridges.

The source of traffic data input for prediction was the field data gathered during the noise measurements and reduced for each hour. The auto and truck volumes and speeds for both main roadway traffic directions and

ramps were encoded on card decks by hour for each site. The standard definition of trucks in PPM 90-2 was applied.

Speed data was taken from the radar unit in the near traffic direction when available, and applied to both directions in the main roadway. When radar speeds were not available, the posted speed limits were used. This was 50 mph on main roadways at the time of the surveys.

Tables of the traffic data used for prediction are presented for each site in Appendix A.

6.2 Transportation Systems Center (TSC) Prediction Program

6.2.1 Program Description

The TSC Program used for prediction is the Traffic Noise Prediction Model MOD2 written in FORTRAN IV by the Transportation Systems Center. It is used in accordance with "Fundamentals and Abatement of Highway Noise" by Bolt, Beranek, and Newman, Reference 3. It has been adapted for use on the New Jersey Department of Transportation IBM 370/145 computer. The program has been modified to accommodate 25 roadway elements and to ignore "zero" length roadway segments in the barrier calculations. It is catalogued and operated in the batch mode with card input and line printer output.

6.2.2 Input Preparation

The input for the TSC program is submitted in five sections with a prefatory title card and an end of data card for a given roadway with given receiver, barrier and traffic data. Section No. 1 contains initialization parameters, No. 2 contains roadway element coordinates and traffic data, No. 3 contains barrier section coordinates, No. 4 contains ground cover information, and No. 5 contains receiver coordinates.

The applicable coordinate data for each site was generated directly from the coordinate data prepared from plans and surveying. The traffic data for one hour of measurement was included in the input set for the site. To rerun the input set for a different hour with different traffic data, the entire section No. 2 must be resubmitted with a new title card and an end of data card. The other sections do not have to be resubmitted for the same site geometry.

Since the traffic data changes from hour to hour over the span of measurement at the site, a highly repetitive input deck is required to predict all hours measured at the site. Rather than generate such a deck for the TSC program from source documents, an intermediate program was developed for this purpose.

The intermediate program was run on the time-shared terminal facility. The input deck for it was the roadway, traffic barrier, and receiver data for the first hour in the form suitable for TSC input. This was followed by another deck with just the traffic data for the remaining hours. The output was a disk file the contents of which were punched into a card deck with the complete input for the first hour, followed by a complete section No. 2 containing roadway and traffic data for the second hour with appropriate title card and end of data card. The remaining hours followed in like manner so that the deck was suitable for input to the TSC program.

6.2.3 TSC Program Output

The output from the TSC program was standard form printout from the line printer. The noise levels were not put on a separate file suitable for input into the statistical analysis programs, but had to be extracted manually for encoding later. The L_{10}'s are tabulated in Appendix B for each site.

6.3 Michigan Prediction Program

6.3.1 Program Description

The Michigan program used for prediction is the Traffic Noise Level Predictor Computer Program Version No. 6 written in FORTRAN IV by the Michigan Department of State Highways. This version incorporates the noise prediction method of NCHRP Report No. 117 and the modifications of NCHRP Report No. 144. It has been adapted to operate on the New Jersey Department of Transportation IBM 370/145 time-shared terminal facility with terminal input and output.

6.3.2 Input Preparation

The input geometry data for the Michigan program was prepared on forms from the graphical presentation of plans and surveying. The input is typed directly from the forms into the terminal in an interactive mode. The output is produced on the same terminal. The noise levels for one hour and one position can be obtained this way, but for many hours and many positions, as necessitated by the nature of this study, the terminal time is prohibitive. Even with the limited ability to shift receiver positions for the same site and traffic data, a highly repetitive input procedure is required to complete one site. Either the program had to be modified to accelerate data input or the input/output procedure had to be changed.

The problem was solved, without time-consuming program modification, by choosing an alternative input/output scheme. The terminal input was assigned to a disk file and the output, to a line printer. This accelerated the process at least two orders of magnitude.

The disk file input to the Michigan program was created by an intermediate program. The input to the intermediate program was a deck containing the geometry and traffic data for the first hour at all applicable positions at a site, followed by the traffic data for the remaining hours from the TSC intermediate program input. The data had to be converted to total volume and truck percentage in the intermediate program to be used by the Michigan program. The output was a disk file with the data for the first hour followed by identical data, except for traffic, for the second hour, third hour, and so on, in a form suitable for input to the Michigan Program.

6.3.3 Michigan Program Output

The output from the program was spooled into a line printer which produced standard form printout. The L_{10} noise levels were extracted manually from the printout and tabulated in Appendix B for each site for later input to the statistical analysis programs.

6.4 Individual Site Prediction

The general TSC and Michigan computer program prediction methods were applied to the different sites, barriers, roadways and receivers. In addition, prediction program inputs and predicted level output adjustments were developed to conform to the individual site noise attenuators and configuration.

The application of the prediction techniques to each site will be discussed in this section. An abbreviation for site titles will be introduced. It consists of a site letter code followed by the microphone position numbers of the site. When referring to an individual position for a site, the letter code will be followed by just the position number.

Route 29, Section 13A (Residential) - R12

The general prediction program inputs of roadways, receivers and barriers were required in the programs' input. However, the two rows of houses in the noise propagation path were treated independently as noise attenuators.

For the Michigan program, the attenuation was determined from Reference 5, as 4.5 dB for the first row and 1.5 dB for the second row of houses. This was a total of 6 dB attenuation, which was input directly into the Michigan program.

For the TSC program, the attenuation was determined from Reference 3, as 3 dB for the first row and 3 dB for the second row of houses. This was a total of 6 dB attenuation which was used to adjust L_{10} levels predicted by the TSC program assuming no houses.

No speed data were obtained by radar for this site; speeds were assumed to be 50 mph for trucks and autos. Auto speed and truck speed were not considered as variables for the step-wise regression.

Route 29, Section 13A (Stacy Park) - S123

The general prediction program inputs for roadways, receivers, and barriers were sufficient to represent this site.

No speed data were obtained by radar for this site; speeds were assumed to be 50 mph for trucks and autos. Auto speed and truck speed were not considered as variables for the step-wise regression.

Route I-78, Section 2B (Clinton) - C1234

The general prediction program inputs for roadways, receivers, and barriers were sufficient to represent this site.

No speed data were obtained by radar for this site; speeds were assumed to be 50 mph for trucks and autos. Auto speed and truck speed were not considered as variables for the step-wise regression.

Route I-78, Section 2M & 3E (Annandale) - A1234, A5678, A9101112

This site was selected because it had three types of roadway configurations acting on the same line of traffic. The site was analyzed as three distinct subsites. Each subsite consisted of the line of microphones perpendicular to the roadway at the depression, the transition between elevated and depressed, and the elevation. The depressed roadway consisted of microphone positions 1, 2, 3 and 4; it was designated site A1234. The transition roadway consisted of microphone positions 5, 6, 7 and 8; it was designated site A5678. The elevated roadway consisted of microphone positions 9, 10, 11 and 12; it was designated site A9101112.

This arrangement included one position from each of the four parallel measurement ranks in each of the three sites. The traffic data were different for each position in a given subsite.

The general prediction program input for roadways, receivers, and barriers was sufficient to represent each of the three sites at Annandale.

Radar speed data were obtained only for the fourth rank of microphones, positions 4, 8 and 12. The other ranks had either no radar data or erroneous data. Speeds were assumed to be 50 mph for trucks and autos in those ranks. Auto speed and truck speed were not used as variables in the step-wise regression.

Route I-287, Section 1E, 4B & 5B (Bridgewater) - B123

The general prediction program inputs for roadways, receivers, and barriers were used to represent this site. The wooded area alongside the microphones due to its location, did not significantly block the noise propagation path to the microphones.

The woods were not explicitly accounted for in the Michigan program for the above reason. The woods were input, however, to the TSC program as an assorbing ground strip in Section #4 of the input. The strip was represented by the rectangle in the graph of the site in Appendix B. This method was used in lieu of the recommendation of Reference 3, to determine an attenuation for the woods and then adjust predicted levels. The absorbing ground strip produced no effect on predicted noise levels.

Radar speed data were obtained at this site. Auto speed and truck speed were used as input variables in the step-wise regression.

Route I-80, Section 1B & 2L (Netcong) - N124, N58

This site was divided into two distinct subsites depending on the primary noise sources. Three positions, 1, 2 and 4 were influenced by I-80 and a ramp. They were designated as site N124. Two positions, 5 and 8 were influenced by Route 206 and a ramp. They were designated as site N58.

The general prediction program inputs for roadways, receivers, and barriers were used to represent sites N124 and N58. Woods were located extensively around the microphone positions. Reference 3 requires that dense woods be assigned an attenuation of 5 dB per 100 ft. depth not to exceed a total of 10 dB attenuation.

The density of the woods did not warrant this attenuation with the Michigan program, because its assumed attenuation with distance would implicitly account for some attenuation. On the other hand, the TSC program does require woods to be accounted for. Its assumed attenuation

with distance does not explicitly account for ground cover attenuation. Thus the TSC program levels were adjusted down by 5 dB for positions 1 and 5 and 10 dB for positions 2 and 4. Position 8 was not adjusted because it was elevated over the woods with respect to the road.

Radar speed data on the main roadway were obtained for both sites. No radar data was obtained on ramps; speeds were assumed to be 40 mph on the ramps for trucks and autos. The auto speed and truck speed were used as input variables to step-wise regression.

7. Statistical Analysis

7.1 Methodology

7.1.1 Objectives

The data gathered from each site for the statistical analysis consits of observed noise levels, TSC program predicted levels, and Michigan program predicted levels. The data represent the traffic noise throughout each hour at a particular position at a particular site over a period of approximately twenty-four consecutive hours.

One noise descriptor is chosen for the analysis. This descriptor is L_{10} (dBA), the noise level in decibels, A-weighted, exceeded ten percent of each measurement time. The L_{10} represents the highly varying peak noise generated during the measurement period, yet contains sufficient information from the measurement period to assure predictability, by giving the mean peak noise. This is also the design noise level in PPM 90-2. When referring to "noise levels" in this report, the L_{10} (dBA) is implied. These levels are tabulated for each site in Appendix B.

The statistical analysis on the noise levels has two objectives:

1) Comparisons -- To determine how well the predicted levels match the observed levels and how well the predicted levels from both programs match each other in three comparisons:
   a) Observed and TSC (OT)
   b) Observed and Michigan (OM)
   c) TSC and Michigan (TM)
2) Influencing Factors -- To determine what variables, among traffic and geometry data that are input to the programs, influence the differences in the three comparisons, and to derive corrections to the predicted levels from these variables.

7.1.2 Comparisons

The first objective, to compare observed and predicted levels against each other, is approached in two ways for each individual site:

1) Whole site data - All data from all measured hours and all positions at a given site are lumped together as a statistical sample of paired levels for each comparison.
2) Individual position data - All measured hours from each position at a site are considered as a statistical sample of paired levels. There are as many samples considered separately as there are positions at a given site.

The statistical methods used to achieve the objective with the samples generated by the two approaches are:

1) Student's t-test on differences between compared levels.
2) Linear regression and correlation between compared absolute noise levels.

7.1.2.1 Student's t-test

For the Student's t-test, differences in compared levels will be defined as follows for the three comparisons:

1) Observed and TSC (OT)

$$d_{ij}^{OT} = O_{ij} - T_{ij}$$

2) Observed and Michigan (OM)

$$d_{ij}^{OM} = O_{ij} - M_{ij}$$

3) TSC and Michigan (TM)

$$d_{ij}^{TM} = T_{ij} - M_{ij}$$

Where the convention taken throughout the report is:

O_{ij} = Observed L_{10} for i^{th} hour and j^{th} position at a site.

T_{ij} = TSC program predicted L_{10} for i^{th} hour and j^{th} position at a site

M_{ij} = Michigan program predicted L_{10} for i^{th} hour and j^{th} position at a site

d_{ij}^{XY} = Difference in L_{10} for i^{th} hour and j^{th} position at a site between levels X_{ij} and Y_{ij} (X, Y = O, T, M).

The mean difference for the whole site data is given as:

$$\bar{d}^{XY} = \frac{1}{\sum_{j=1}^{N} N_j} \sum_{j=1}^{N} \sum_{i-1}^{N_j} d_{ij}^{XY}$$

where N_j = Total number of hours at j^{th} position

N = Total number of positions

The mean difference for the j^{th} individual position data is given as:

$$\bar{d}_j^{XY} = \frac{1}{N_j} \sum_{i=1}^{N_j} d_{ij}^{XY}$$

The other statistical parameter necessary for the t-test is the standard deviation among the differences used in determining the mean difference.

The standard deviation for whole site data is defined as:

$$s^{XY} = \sqrt{\frac{\sum_{j=1}^{N}\sum_{i=1}^{N_j}\left(d_{ij}^{XY} - \bar{d}^{XY}\right)^2}{\sum_{j=1}^{N} N_j - 1}}$$

The standard deviation for the j^{th} individual position data is defined as:

$$s_j^{XY} = \sqrt{\frac{\sum_{i=1}^{N_j}\left(d_{ij}^{XY} - \bar{d}_j^{XY}\right)^2}{N_j - 1}}$$

The ideal difference for the mean differences is zero. That is, no differences between compared levels would exist under either the whole site or individual position approach. This is the null hypothesis.

The Student's t-test allows this hypothesis to be tested at a predetermined level of significance. In this report, the 5 percent level of significance for a two-tailed test will be used for all t-tests. This implies that there would be one chance in forty that the mean difference is either greater or less than zero should the null hypothesis be accepted -- a Type II error.

The Student's t-statistic is calculated for whole site data as:

$$t^{XY} = \frac{\overline{d^{XY}}}{\frac{s^{XY}}{\sqrt{\sum_{j=1}^{N} N_j}}}$$

with $\sum_{j=1}^{N} N_j - 1$ degrees of freedom.

The Student's t-statistic for the j^{th} individual position data is:

$$t_j^{XY} = \frac{\overline{d_j^{XY}}}{\frac{s_j^{XY}}{\sqrt{N_j}}}$$

with $N_j - 1$ degrees of freedom.

The absolute values for t are compared to the critical values of the t distribution at the .025 probability point for the two-tailed test, given the indicated degrees of freedom of the samples.

7.1.2.2 Linear Regression

The second statistical method to achieve the first objective is to compare paired noise levels under each comparison using simple linear regression. In this technique, the ideal linear relationship between the levels is checked. If one set of noise levels is plotted as X (independent) against the other as Y (dependent), the ideal line through the points would be a straight line with unit slope, passing through the origin, that is, Y = X.

The regression chooses the best straight line $Y = a + bX$ through the data points by minimizing the differences between the data point Y value and the best straight line value at the plotted X value. Thus due consideration must be given to assigning the Y and X coordinates between compared levels.

To reflect the attempt at predicting observed noise levels, the predicted noise level is chosen for the X coordinate, and the observed, for the Y coordinate. When comparison between two sets of predicted levels is made, the Michigan level is the X coordinate and the TSC level the Y coordinate. This reflects the attempt to relate the empirical Michigan levels to the "first-principle" levels of the TSC program.

The comparison to the ideal line is made from the parameters of the regression, which are:

Regression Coefficient (b) -- The slope of the regression line, ideally unity.

Standard Error of the Regression Coefficient (s_b) -- The measure of scatter in the regression coefficient.

Intercept (a) -- The Y-axis intercept of the regression line.

F-statistic -- Used in the F-test of significance at the 5% level to determine how reliably the regression analysis accounts for the variance.

Degrees of Freedom -- The sample size less the number of statistical parameters used in the analysis.

Standard Error of Estimate ($s_{X/Y}$) -- The measure of scatter in the Y direction of the data points about the regression line.

Correlation (r) -- The square root of the fraction of the Y variance accounted for by the regression on X.

The correlation may be compared to zero in a test of significance. However, it is more profitable to look at its absolute value to determine the relationship demonstrated between the two variables. This interpretation is facilitated by the following table from Reference 8:

Table 1

Interpretation of the Correlation Coefficient

Correlation Coefficient	Relationship Demonstrated
1.0	Perfect
0.9	Very Good
0.8	Good
0.7	Fair
0.6	Poor
0.5 or less	Very Poor

Regression Coefficient Equals Unity -- An additional statistic is generated from the regression results. The slope of the regression line can be checked against unity by a t-test. The t-statistic is obtained from the following formula:

$$t_b = \frac{b-1}{s_b}$$

where the number of degrees of freedom are:

$\sum_{j=1}^{N} N_j - 2$ for whole site data, and

$N_j - 2$ for individual position data.

The check against the critical t value is made at the 5 percent level in a two-tailed test. The null hypothesis is that the slope is unity, corresponding to a constant offset of compared levels. The offset would be best represented by the mean difference between the compared levels found for the Student's t-test on differences.

7.1.3 Influencing Factors - Step-wise Regression

The second objective of the analysis is to determine the factors influencing the differences in compared levels and corrections to predicted levels. This objective is met by step-wise regression.

Step-wise regression is a procedure whereby independent variables are selected in order of importance in steps of one variable and entered in a multiple linear regression model against a dependent variable.

The theory is given in Appendix D. The steps are terminated for our purpose when a variable selected is not statistically significant as determined by a t-test on the partial regression coefficient, or when it is not independent.

For this analysis, the independent variables are the traffic and geometric data used by the prediction programs to compute noise levels for the whole site. The dependent variable is not an absolute noise level but is the difference between compared levels.

Independent variables used in the step-wise regression are:

1) Total auto volume on main roadway
2) Total truck volume on main roadway
3) Observer-near lane distance
4) Observer height

5) Auto speed*

6) Truck speed*

Additional variables may be derived from traffic volumes. These are not strictly independent variables, but they are added to the independent variable list for step-wise regression to enlarge the possibilities.

The derived variables are:

7) Total volume on main roadway

8) Truck percentage

9) Auto/truck ratio

10) Truck/auto ratio

Using step-wise regression, the most significant variable affecting the differences in compared levels are selected in order of importance among the original and derived variables. However, there can be only two independent variables based on traffic volumes in the final set of significant variables.

The set of independent variables at a given step is entered in a multiple linear regression model against the differences in compared levels. The multiple regression fits to the data points, the equation:

$$d = a + \sum_{i=1}^{n} b_i v_i$$

where d is the difference in compared levels, the dependent variable, V_i, i = 1,....., n are the independent variables, and a and b_i are constants.

The equation represents a plane in d - V_i space and may be used to derive the correction factors for the predicted levels.

*It is to be noted that where the speed is a constant for all differences, it cannot be included in the regression.

The statistics produced by the multiple regression on significant independent variables are:

Partial Regression Coefficient (b_i) -- The coefficient of the i^{th} independent variable in the multiple regression equation.

Standard error of the partial regression coefficient (s_{b_i}) -- The measure of scatter about the value of b_i.

Partial Correlation Coefficient (r_i) -- The measure of correlation of the i^{th} independent variable to the dependent variable with the influence of other independent variables removed.

Intercept (a) -- The intercept of the regression plane with the dependent variable axis.

F-statistic -- Used in the F-test of significance at the 5% level to determine whether the regression analysis reliably accounts for the variance about the regression plane

Degrees of Freedom -- The sample size less the number of statistical parameters used in the analysis.

Multiple Correlation Coefficient (r) -- The overall measure of correlation of all the independent variables to the dependent variable.

Standard error of estimate (s_b) -- The measure of scatter in the dependent variable direction about the regression plane.

t-Statistic of Variable -- At each step in the step-wise regression, the null hypothesis, that the partial regression coefficient of the selected variable is zero, is tested. A t-statistic derived from the regression data for a significance test, which compares the partial regression coefficient to zero in the following formula:

$$t_{b_i} = \frac{b_i}{s_{b_i}}$$

with $\sum_{j=1}^{N} N_j - n - 1$ degrees of freedom.

where, N_j = Total number of hours at the j^{th} position

N = Total number of positions

n = Number of independent variables at a step

When an independent variable is found not to be significantly different from zero, the step is omitted and the step-wise regression terminated. The multiple regression from the previous step represents the final set of independent variables if it does not contain more than two traffic volume variables. If it does then that step is omitted and the one before that chosen as the final set of independent variables.

7.1.4 Corrections to Predicted Data

The multiple regression equation derived from step-wise regression represents a model of the site from which corrections to the predicted data can be derived.

The value of such a model in correcting predicted levels depends on two statistics: a) the multiple correlation coefficient and b) the standard error of estimate of the multiple regression.

a) Multiple correlation coefficient - This is a measure of how well the regression accounts for the variation in the differences between observed and predicted levels. The criterion on the multiple correlation coefficient can be arbitrarily established from the interpretation of the correlation coefficient given in Table 1 in Section 7.1. Thus, an acceptable, model should have at least a "good" correlation coefficient to be acceptable, that is, around 0.8.

b) Standard Error of Estimate - This is a measure of how close the tolerances on the differences between the observed and predicted levels are. Two criteria can be established for the standard error of estimate.

The first criterion is that the standard error of estimate be at least "reasonable". This criterion can be arbitrarily established by setting up Table 2 below.

This table defines the standard errors of estimate relative to the data, similar to Table 1 for the correlation coefficient.

Table 2

Interpretation of the Standard Error of Estimate

Standard Error of Estimate	Description
0 dB - 1.5 dB	Small
1.5dB - 3 dB	Reasonable
3dB or more	Large

The second criterion on the standard error of estimate is that it be less than or equal to that obtained by simple linear regression between observed and predicted levels. Note that simple linear regression between observed and predicted levels attempts to explain the variation in the data without introducing any prediction program input variables as step-wise regression does. The standard error of estimate from simple regression is a measure of the tolerance between observed and predicted levels. If this tolerance is reduced by the multiple regression model, this implies that the introduction of prediction program input variables reduces the systematic error inherent in the prediction program levels.

A procedure for obtaining corrections to predicted levels for a particular site was developed from the analysis used in this study. This procedure can be used by others provided that the means for implementation exists. The steps are as follows:

1) Measure noise levels at positions of interest at the site. A group of positions at various distances from the road or one position may be chosen. Measurements may be made for 24 consecutive hours or just those hours of interest for more than one day. Traffic data must be collected during noise measurements.

2) Predict noise levels for the site for the hours measured. Geometry data from plans and field surveying must be collected for prediction.

3) Perform statistical analysis on the pairs of observed and predicted levels for the whole site.

   a) t-test on differences between observed and predicted levels

   b) Linear regression between observed and predicted levels

   c) Step-wise regression on differences between observed and predicted levels and the input variables to the prediction method.

4) If the predicted levels are significantly different from the observed levels, determine if the multiple regression equation obtained from step-wise regression meets the three criteria for an adequate model to correct predicted levels:

   a) Multiple correlation coefficient is "good"

b) Multiple regression standard error of estimate is "reasonable"

c) Multiple regression standard error of estimate is less than or equal to simple linear regression standard error of estimate

These criteria are used in Section 7.3 to evaluate the multiple regression equations for each site in the study.

5) Correct predicted levels. The site regression model can be used to correct predicted levels at that site. All that is necessary, is to input the appropriate traffic and geometric data into the equation and compute the difference between predicted and observed levels. Then add that difference to the predicted level generated by the prediction method.

The multiple regression model of the particular site can also be applied to a "similar" site for which predictions must be made. A group of such sites may be catalogued for future use in prediction. In addition, the catalogued model equations may be updated as prediction methods improve or as new methods are introduced.

7.2 Statistical Analysis Program

7.2.1 Implementation

The statistical analysis of the data was implemented by using STATPACK, an interactive terminal software facility on the NJDOT IBM 370/145 computer, Reference 10. This package of programs performed all the statistical analysis required -- t-test, linear regression and correlation and step-wise regression. The standard input/output is such that input data can be supplied either from the terminal or disk with interactive commands and output done on the terminal only. The large number of data

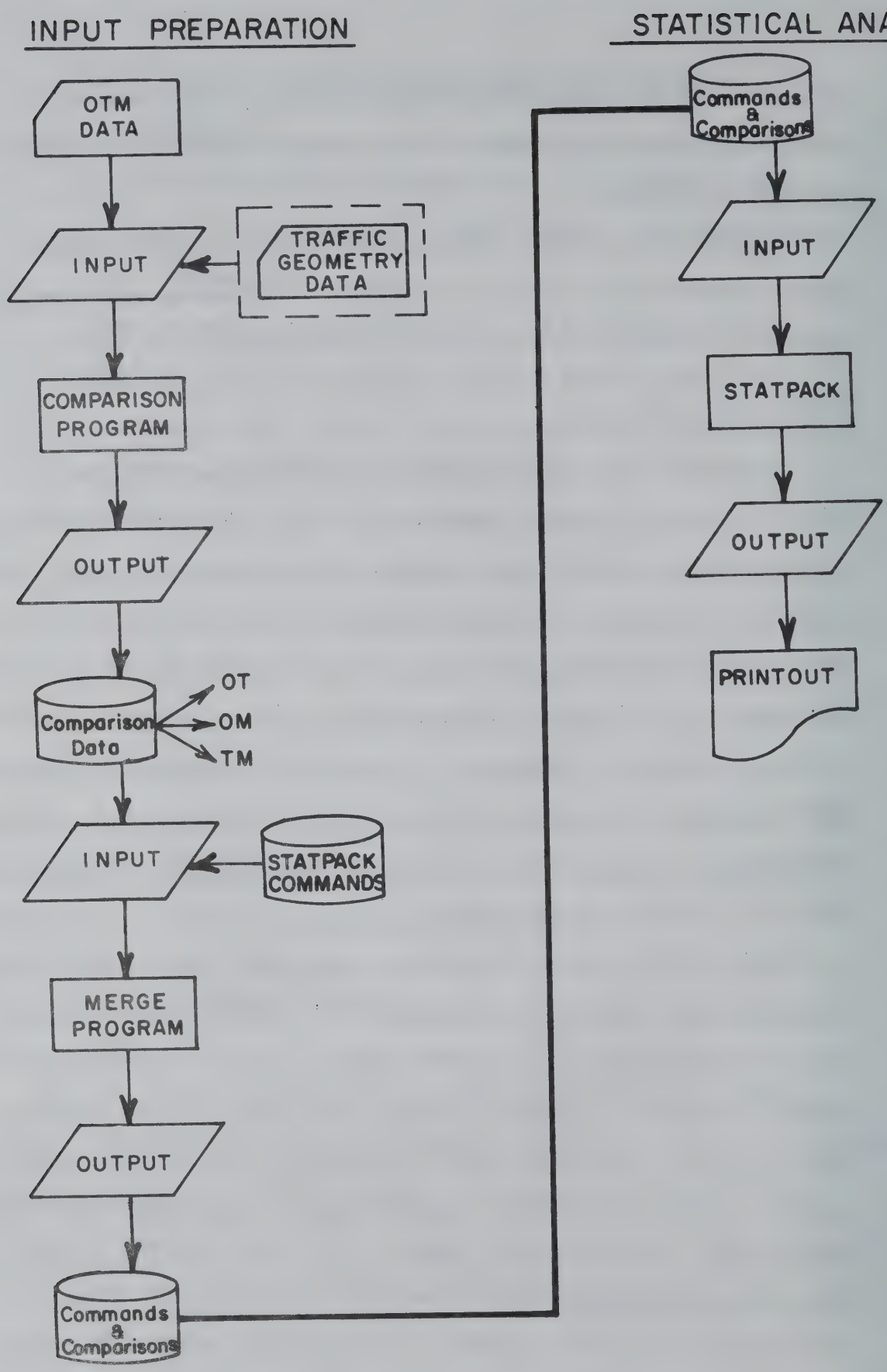
sets to be run form comparisons through STATPACK and the number of repetitious interaction commands to the program precluded use of the standard input/output.

To reduce the analysis to manageable proportions, the terminal input to STATPACK was assigned to a disk file containing both data and interactive commands and the output was spooled to a line printer.

7.2.2 Input Preparation

The disk file for STATPACK input was prepared according to the flowchart shown in Figure 3, page 44. The first step was the coding of source decks for observed and predicted data. One such deck was created for each analysis site. The deck consisted of one card for each hour at each position containing the observed, the TSC predicted, and the Michigan predicted L_{10} to the nearest tenth decibel. It also included identification of the site, position, and hour. The card deck is labelled OTM data in Fggure 3 to show it contains observed, TSC, and Mighigan data. Each deck was processed by two programs twice, once for individual position statistics and once for whole site statistics.

When performing whole site analysis additional data for the traffic and geometry was included in the source deck. This is shown by dashed lines in the flowchart. The traffic data was just the input to the prediction intermediate programs with the total truck and auto volumes on the main roadway computed by the first program. The near lane speed was used for trucks and autos. The geometry data was taken from the Michigan program input. It included the observer-near lane distance and observer height, when applicable.



STATISTICAL ANALYSIS FLOWCHART

FIGURE 3

The source deck served as input to the comparison program in the flowchart. This program assembled the OTM data into the three comparisons observed to TSC predicted (OT), observed to Michigan predicted (OM), and TSC predicted to Michigan predicted (TM). The output of the comparison program was a disk file containing a data set for each of the three comparisons.

The comparison data file served as input to the merge program. The merge program combined the comparison data with a set of STATPACK interactive commands repeated for each of the three comparisons. The STATPACK command disk file was created separately. The output of the merge program was the command and comparison disk file.

The command and comparison disk file served as input to STATPACK. Each comparison could be processed by its corresponding set of commands to STATPACK for the statistical analysis.

7.2.3 Output

The output was spooled on a line printer from STATPACK. The printout contained the program interactions and the complete results of the statistical methods used to process the data sets.

7.3 Results of Statistical Analysis

7.3.1 Introduction

The output of STATPACK was collated and the statistics of interest were tabulated for each of the three comparisons - observed to TSC predicted levels, observed to Michigan predicted levels, and TSC predicted to Michigan predicted levels in Appendix C. Each comparison is further broken down into whole site and individual position tables. Each site's

results are enumerated in these tables. The site letter and position number code is used to identify site and position data.

The results are discussed qualitatively in Section 7.3.2 through Section 7.3.10 for each analysis site. There are nine analysis sites, which are discussed separately in regard to the two comparisons between observed and predicted levels - observed to the TSC predicted and observed to Michigan predicted. The evaluation of the two programs' effectiveness in prediction at a particular site is treated according to the following format:

Analysis Site

A. Comparisons - Elementary Statistics and Regression

A.1 Whole Site Statistics

A.1.1 t-test on differences between observed and predicted levels for TSC and Michigan programs

A.1.2 Linear regression and correlation between observed and predicted levels for TSC and Michigan programs

A.2 Individual Position Statistical Data

A.2.1 t-test on differences for TSC and Michigan program

A.2.2 Linear regression and correlation for TSC and Michigan programs

B. Influencing Factors - Step-wise Regression

B.1 Multiple regression equations for TSC and Michigan programs

B.2 Multiple correlation coefficients and standard errors of estimate for TSC and Michigan programs

B.3 Discussion of factors

C. Conclusions

Two statistics will be used to characterize the simple linear and multiple regressions -- the correlation coefficient and the standard error of estimate. The correlation coefficient will be described in terms of Table 1, page 35 -- Interpreting the Correlation Coefficient. The standard error of estimate will be described in terms of Table 2, page 40 -- Interpreting the Standard Error of Estimate.

The regressions will be assumed to be valid if the F-test on the variance accounted for by regression is passed at the 5 percent level of significance. If a particular regression fails the F-test a comment will be made in the discussion, otherwise, no mention of the results of the F-test will be made. In addition, those linear regression coefficients which are statistically equal to unity will be mentioned in the discussion as showing a constant offset of compared noise levels. The relative importance of the variables chosen by step-wise regression was determined by the partial correlation coefficients of the variables. The larger the magnitude of the partial correlation coefficient of the variable, the more major an influence it was on the differences between observed and predicted levels.

The results of the TSC predicted versus Michigan predicted levels comparison is discussed in general for all sites in Section 7.3.11. The discussion follows the outline above. The overall difference in the two programs' predictions for the same site parameters and traffic variables is evaluated.

7.3.2 Route 29, Section 13A (Residential) - R12

Comparisons - Elementary Statistics and Regression

The t-test on the differences between the observed and predicted levels showed both the TSC and the Michigan programs predicted the observed

levels at the site. In addition, the correlation between observed and predicted levels was very good and the simple linear regression standard error of estimate was reasonable for both programs.

For individual position statistical data, the t-test on differences and the linear regression and correlation between observed and predicted levels for both programs was comparable to the whole site results. There was no significant variation in the data between the two positions.

Influencing Factors - Step-wise Regression

The multiple regression equations for this site are:

TSC: $d = 2.83687 - 0.05603$ (Truck volume) $- 0.00073$ (Total volume)

Michigan: $d = 2.03501 - 0.00156$ (Total volume)

The multiple correlation coefficient was fair for the TSC but poor for the Michigan program. The standard errors of estimate were larger than the standard errors of estimate from simple linear regression between observed and measured levels for both programs.

Truck volume was a major factor in the TSC program with total volume a minor effect. Total volume showed as the only significant factor in the Michigan program. Microphone height instead of distance was included in the step-wise regression because the two positions were at the same distance from the roadway, at different heights. Height failed to appear as a significant variable in the differences between observed and predicted levels. This was probably due to the small difference (7 feet) in height between the microphone positions relative to the large distance (430 feet) from the microphones to the roadway.

This was the only site where houses lay in the propagation path of noise. The TSC program requires that the attenuation from these types of attenuators be used to reduce levels after they are predicted by the program. Since the TSC program actually predicts observed levels with this adjustment, the attenuation used was apparently correct. The TSC program demonstrated a tendency to overpredict at the other sites due to trucks. However, low truck percentages characteristic of Route 29 probably minimized the TSC program tendency to overpredict, further enhancing its accuracy. The observations show that if propagation path attenuation and truck noise levels are more finely specified, the program could accurately predict complex roadway configurations.

The Michigan program predicted observed levels with statistical accuracy, as well. However, closer inspection of the data shows that the low truck percentages characteristic of Route 29 were not treated correctly by the Michigan program. The lowest volumes (below three trucks per hour) were underpredicted. The highest truck volumes at the site were handled the best, but those between the lowest and highest were overpredicted. The Michigan program showed a general tendency to underpredict at the other sites due to lower truck noise emission levels and excess attenuation with distance. The overprediction for low truck volumes demonstrated at this site apparently overcame the inherent excess attenuation with distance enough to insure zero average difference between predicted and observed levels.

Conclusions

The TSC program, without correction, should be used for this site. Although both programs predicted observed levels, the site geometry is more easily handled with the TSC program. The multiple regression models

should not be used at all to correct predicted levels, because the multiple correlation coefficients and the multiple regression standard errors of estimate did not meet the criteria for valid models.

7.3.3 Route 29, Section 13A (Stacy Park) - S123

Comparisons - Elementary Statistics and Regression

The t-test on the differences between the observed and predicted levels showed both the TSC and the Michigan programs both significantly overpredicted the observed levels at the site. Simple linear regression did not show a constant offset of predicted from observed levels. The correlation was good for the Michigan program but fair for the TSC program. The standard errors of estimate from the regression for both programs were large.

For individual position statistical data, the t-test on differences and the linear regression and correlation between observed and predicted levels were comparable to the whole site results.

Influencing Factors - Step-wise Regression

The multiple regression equations for this site are:

TSC: $d = 7.84599 - 0.10427$ (Truck volume) $- 0.11292$ (Distance) $+ 0.00222$ (Auto/truck)

Michigan: $d = -2.02038 - 0.12266$ (Truck volume) $+ 0.28421$ (Height) $+ 0.86926$ (Truck percentage)

The multiple regression was better for the TSC programs than for the Michigan program. The TSC program gave a very good multiple correlation coefficient and reasonable standard error of estimate. The Michigan program gave good multiple correlation and a larger standard error of estimate. The standard errors of estimate for both programs were smaller than the ones obtained from simple linear regression.

The major factor in the TSC program was the truck volume. Distance and the auto/truck ratio were secondary factors in the TSC results. The major factor in the Michigan program was the truck volume with height and truck percentage as secondary factors.

The t-test at the 5 percent level of significance was used to compare the mean differences between Positions 1 and 2 only, exclusive of Position 3. No significant difference was found in the two positions. Since these positions differed only in height, being the same distance from the road, Position No. 3 at a farther distance from the road was responsible for the appearance of microphone height as a significant variable in the step-wise regression. The terrain sloped down to Position No. 3 from the road and probably caused significant attenuation in observed noise levels there. The barrier effect was minimal as the traffic was visible from all positions.

Low truck volumes existed throughout the day at this site and this is shown to affect differences, apparently increasing predicted levels for the Michigan program. The effect is seen in the forward positions where the Michigan program overpredicted by about 3 dB. There is a low-end cutoff on truck volumes, which limits the effect of low volumes. However, when the volume is above cutoff and low at a given position, over-prediction seems to occur. The low truck volumes may have increased predicted levels for the rear positions for the TSC program. The trucks may have acted more like a point source with greater attenuation with distance.

The truck distribution was evenly split between heavy tractor trailers and medium trucks both meeting the definition of PPM 90-2. The extra weight

imposed on the total truck volume by the medium trucks may influnece overprediction to some extent for both programs but less so for the TSC program because of the low overall truck volumes.

These factors caused much greater measured attenuation, 13 dB per doubling of distance, than could be accounted for by both programs but less so, by the Michigan program.

Conclusions

The TSC program with corrections from the multiple regression model is preferable for the site. The multiple correlation coefficient and the multiple regression standard error of estimate meet the criteria for a valid model.

7.3.4 Route I-78, Section 2G (Clinton) - C1234

Comparisons - Elementary Statistics and Regression

For the whole site data, the t-test on the differences between the observed and predicted levels showed the TSC program overpredicted and the Michigan program underpredicted the observed levels at the site. Whole site linear regression showed a constant offset of observed from predicted levels for the TSC program but not the Michigan program. The correlation coefficients were fair and the standard errors of estimate were large for both programs.

The individual position t-tests showed overprediction at every position for the TSC program. However, the Michigan program overpredicted Position 1, was statistically correct at Position 2, and underpredicted Position 3 and 4 by approximately the same amount.

The regressions for the site taken as a whole were not reflected in the individual position data. In fact, every position failed the F-test on the variance accounted for by linear regression for both programs. The correlations were very nearly zero as well. The regression coefficients were even negative for Positions 3 and 4. This shows measured levels increasing as predicted levels decrease.

Influencing Factors - Step-wise Regression

The multiple regression equations for this site are:

TSC: $d = 3.89126 - 0.01679$ (Truck volume) $- 0.00469$ (Distance) $+ 0.52396$ (Truck/auto)

Michigan: $d = 5.16611 - 0.02121$ (Truck volume) $+ 0.00764$ (Distance) $+ 0.59897$ (Truck/auto)

Both the TSC and the Michigan programs had fair to good multiple correlation coefficients and reasonable standard errors of estimate for the differences at the site as a whole. The standard errors of estimate were smaller than those obtained from simple regression between the observed and predicted levels.

Truck volumes had a slight edge over distance as the major factor accounting for the differences between the observed and predicted levels for both programs. The truck/auto ratio appeared as a minor factor. This factor coupled with the heavy dependence on truck volume is probably due to the fact that truck volume was fairly constant throughout the day, while auto volumes dwindled during the early morning hours.

The lack of linearity in the simple linear regressions of all individual position data is not typical of sites included in the study. Inspection of the measured levels in Appendix A does indeed show levels

inconsistent with truck volumes over the measurement day, as the step-wise regression indicates.

The inconsistencies in the data may have been due to trucks stopping at night with engines idling within the measurement site.

The distance factor is probably due to the program's assumed attenuation with distance and the hills which were approximated by knife-edge type barriers.

Conclusions

No judgement can be made on which program is preferable, because of the inconsistencies in the observed data. The predicted levels cannot be corrected by the multiple regression model because it may not apply to all traffic situations encountered at the site.

7.3.5 Route I-78, Section 2M & 3E (Annandale) - A1234

Comparisons - Elementary Statistics and Regression

For the whole site data, the t-test on the differences between the observed and predicted levels showed the TSC program significantly over-predicted while the Michigan program significantly underpredicted at the site. Whole site linear regression did not show a constant offset between observed and predicted levels for either program. Although the correlation was good, the standard error of estimate for the simple regression was large, revealing quite a lot of scatter in the data.

The t-test on differences for individual positions showed the TSC program slightly underpredicting at Position 1, where there was no barrier effect and significant tractor trailer truck volumes. The Michigan program

greatly underpredicted at Position 1. However, at Position 2 the Michigan program had a statistically zero mean difference. The individual position linear regressions failed the F-test for Positions 2, 3, and 4 using the Michigan program and for Positions 3 and 4 using the TSC program.

Influencing Factors - Step-wise Regression

The multiple regression equations for this site are:

TSC: $d = 3.94032 - 0.01183$ (Distance) $- 0.01986$ (Truck volume)

Michigan: $d = 10.42150 - 0.00806$ (Total volume)

Both the TSC and Michigan programs gave very poor multiple correlation coefficients and large standard errors of estimate in the analysis. The latter were as large as the standard errors of estimate obtained from simple regression.

For the TSC program, the major factor was distance with truck volume, a minor factor. These factors were not sufficient to explain the differences between observed and predicted levels. For the Michigan program, total volume was the only significant variable.

The differences between observed and predicted levels for both programs are probably due to the presence of the large earth mound through which the road was cut. It could not be adequately accounted for as a knife-edge barrier. Also, truck distribution affected the Michigan program as shown by the large underprediction of Position 1. Truck percentages averaged over 40 percent with most trucks being tractor trailers. The TSC program, on the other hand, was quite effective in predicting the noise from these trucks at Position 1 without barriers, close by the road.

Conclusions

The TSC program without correction is preferable in this situation. The site geometry is more easily handled using the TSC program. The multiple regression model cannot be used to correct predicted levels because the multiple correlation coefficients and the multiple regression standard errors of estimate did not meet the criteria for a valid model.

7.3.6 Route I-78, Section 2M & 3E (Annandale) - A5678

Comparisons - Elementary Statistics and Regression

For the whole site data the t-test on the differences between the observed and predicted levels showed the TSC program significantly overpredicted while the Michigan program underpredicted the observed results at the site. The regression for the whole site did not show a constant offset of predicted from observed levels. The correlation coefficients were good and the standard errors of estimate were reasonable for both programs, showing little scatter in data with potential for applying corrections to predicted data.

Individual position t-tests were the same as whole site except that the Michigan program had statistically zero mean differences between observed and predicted levels for Positions 5 and 6. The TSC program had statistically constant offset of predicted from observed levels for Position 5.

Influencing Factors - Step-wise Regression

The multiple regression equations for this site are:

TSC: $d = -4.59749 + 0.00368\ (\text{Distance}) - 0.00309\ (\text{Total volume})$

Michigan: $d = 1.85296 + 0.00864\ (\text{Distance}) - 0.00392\ (\text{Total volume})$

The Michigan program had good correlation and reasonable standard error of estimate, while the TSC program had very poor correlation and reasonable standard error of estimate. Both programs multiple regression standard errors of estimate were just 0.2 dB greater than those obtained from simple linear regression between observed and predicted levels.

In both programs, the differences were dependent primarily on distance and secondarily on total volume. Since this site was a transition zone, apparently the ground attenuation effect over extended earth barriers and the sudden appearance or disappearance of traffic from the depressed roadway influenced the differences.

Conclusions

The Michigan program corrected by the multiple regression equation should be used for the site. The Michigan program predicts better than the TSC program for this site without correction. In addition, the multiple correlation coefficient and the standard error of estimate for the Michigan program effectively meet, to within 0.2 dB for the standard error of estimate, the criteria for a valid multiple regression model for the site.

7.3.7 Route I-78, Section 2M & 3E (Annandale) - A9101112

Comparison - Elementary Statistics and Regression

For the whole site data, the t-test on the differences between the observed and predicted levels showed the Michigan program underpredicted, while the TSC program overpredicted observed noise levels at the site. The regression of predicted levels on observed levels showed no constant offset of predicted from observed levels. The simple regression correlation coefficient was poor for the Michigan program and negative for the TSC program.

Individual position t-test data showed that the TSC program slightly underpredicted the two near positions affected by the elevated roadway and badly overpredicted the two far positions unaffected by the elevated structure. The Michigan program slightly underpredicted the nearest position and underpredicted more at the other positions. The linear regressions showed no constant offset of predicted from observed levels.

Influencing Factors - Step-wise Regression

The multiple regression equations for this site are:

TSC: $d = + 6.57787 - 0.01592$ (Distance) $- 0.01404$ (Truck volume)

Michigan: $d = + 5.79443 - 0.01821$ (Truck volume) $+ 0.00189$ (Distance)

The TSC program gave a very good multiple correlation coefficient, while the Michigan program gave a poor one. The standard errors of estimate were reasonable and less than the ones given by simple regression between observed and predicted levels.

The major influence on the TSC program was distance with truck volume minor. The major influence on the Michigan program was truck volume with distance very minor.

This was the only site with a well defined knife-edge barrier, consisting of the roadway edge. It strongly influenced levels at the two near Positions 9 and 10, but did not significantly affect the far Positions 11 and 12.

Both programs ostensibly predicted Position 9, the nearest position well. However, the traffic that passed Position 9 also passed Position 1 without barriers at Site A1234 (See Section 7.3.5) simultaneously. Both

positions were measured in parallel. The data for Position 1 showed that the Michigan program greatly underpredicted the traffic source but the TSC made fairly accurate predictions.

Thus, it can be assumed that the Michigan program did not accurately predict the source for Position 9. Moreover, the elevated roadway barrier approximation compensated for the source underprediction concealing the errors in the predicted levels. On the other hand, the TSC program can be assumed to have predicted the source level and the elevated roadway barrier attenuation accurately enough to predict the resultant levels at Position 9. Since the small difference between observed and predicted levels was the same at Position 10 for the TSC program, these levels can be assumed fairly accurate as well. The levels predicted for near positions affected by an elevated roadway can be reliably predicted by the TSC program.

The combination of distance and truck volume factors at this elevated site provided evidence that the TSC program may overpredict because of the line source model for trucks at far positions. The attenuation with distance due to terrain is of little effect at this site, due to the elevated roadway. The attenuation with distance then would be due to source characteristics primarily. However, greater attenuation with distance is measured than predicted by the TSC program at the far positions, for which barrier attenuation is negligible especially for the tractor trailers at this site. Thus, the trucks may be better represented as discrete point sources rather than a continuous line source at long distances with greater noise attenuation with distance.

Conclusions

The TSC program with corrections should be used for this elevated site. The multiple correlation coefficient and the multiple regression standard

error of estimate for the TSC program meet the criteria for a valid model. The TSC predictions are close to observed levels for near positions but have to be corrected for far positions.

7.3.8 Route I-287, Section 1E, 4B and 5B (Bridgewater) - B123

The whole site analyses and step-wise regression for observed versus predicted levels consisted only of Positions 1 and 2. Position 3 was not included because its observed levels were too low to be explained by any obvious noise attenuator at the site. Since clean data was obtained at the site, the low levels at Position 3 may have been due to some characteristic of the area.

Comparisons - Elementary Statistics and Regression

For the whole site data the t-test on the differences between the observed and predicted levels showed the TSC program significantly overpredicted observed levels. However, the Michigan program underpredicted by just 0.8 dB. Whole site regression did not show a constant offset between observed and predicted levels for the TSC program, but it did for the Michigan program. The correlation was good for both programs and the standard errors of estimate reasonable.

Individual position t-tests showed the TSC program overpredicted progressively more for Positions 1 through 3. At Position 1 there was a constant offset of predicted from measured data. The Michigan program, on the other hand, underpredicted Position 1, was statistically accurate at Position 2, and overpredicted Position 3.

Position 3 seems to be an anomaly. The correlation and regression coefficients are nearly zero. A look at the plot of the observed against predicted levels, shows an increasing trend of observed levels with

increasing predicted levels, then an abrupt drop of observed levels, with the highest predicted levels. The higher predicted levels correspond to higher truck volumes, so there may be a problem in the treatment of trucks in the two programs.

Influencing Factors - Step-wise Regression

The multiple regression equations for this site are:

TSC: $d = -26.20389 - 0.04517$ (Distance) $+ 0.53210$ (Truck speed) $- 0.00404$ (Truck volume)

Michigan: $d = -31.75734 - 0.00913$ (Truck volume) $- 0.02117$ (Distance) $+ 0.69697$ (Truck speed)

The multiple correlation coefficient was very good for the TSC program and good for the Michigan program. The standard errors of estimate were small for both porgrams and less than those obtained from simple linear regression between observed and predicted levels.

The major variable was distance in the TSC program with minor contributions from truck speed and truck volume. In the Michigan program, truck volume, distance, and truck speed, in that order, were almost equally important variables, though none was a major variable. The appearance of truck speed as an important variable at this site indicates that exact truck speed, if included, might have explained some of the variance in the data at the preceeding sites for which exact speed data was not obtained.

Conclusions

The Michigan program with corrections should be used for this site. The multiple regression model can be used for correction of predicted levels because the multiple correlation coefficient and the multiple regression standard error of estimate meet the criteria for a valid model.

7.3.9 Route I-80, Section 1B & 2L (Netcong) N124

Comparisons - Elementary Statistics and Regression

For the whole site data, the t-test on the differences between the observed and predicted levels showed the TSC program predicted the observed levels and the Michigan program underpredicted by just a decibel at the site. Whole site regression did not demonstrate a constant offset between observed and predicted levels. The correlation coefficients were good and the standard errors of estimate were reasonable for both programs.

Individual position data showed both programs overpredicted Position 1, with the Michigan program closer to observed levels. The Michigan program also overpredicted the intermediate Position 2 while the TSC did predict it. The TSC program also came to within a decibel of Position 4, but the Michigan program underpredicted it. Linear regression showed a constant offset for every position between predicted levels and observed levels for the TSC program, and just Position 1 for the Michigan program.

Influencing Factors - Step-wise Regression

The multiple regression equations for this site are:

TSC: $d = 11.87212 + 0.00539\ (\text{Distance}) - 0.34045\ (\text{Truck speed})$

Michigan: $d = -1.15973 - 0.00129\ (\text{Total volume}) + 0.00477\ (\text{Distance})$

Both the TSC program and the Michigan program had poor multiple correlation coefficients for the multiple regression. The standard errors of estimate were reasonable and less than those from simple linear regression between observed and predicted levels.

The differences between observed and predicted levels were influenced by distance for both programs. Truck speed also influenced the TSC program and total volume influenced the Michigan program.

Since the multiple correlation coefficients were poor, these factors do not strongly explain the differences between observed and predicted levels. However, both programs did well for the site as a whole in predicting the observed levels. This was apparently due to the explicit consideration of the woods around the microphones in the TSC program and the upgrade on I-80 in the Michigan program. The attenuation for woods corrected the TSC program's assumed attenuation with distance. The upgrade correction corrected the Michigan program's assumed truck emission level.

This site was also one for which radar speed data was obtained. The appearance of truck speed as a variable in the TSC program, for this site and the site preceeding may indicate that the truck source model in the TSC program needs modification. The truck speed critically determined the configuration of the line source model for trucks assumed by the TSC program.

Conclusions

The TSC program would be the program of choice, without correction, at such an interchange site, where propagation path attenuation can be explicitly defined for the program. The multiple regression model correlation coefficient does not meet the criteria for a valid model and cannot be used to correct predicted levels.

7.3.10 Route I-80, Section 1B and 2L (Netcong) - N58

Comparisons - Elementary Statistics and Regression

For the whole site data the t-test on the differences between observed and predicted levels showed that the TSC program overpredicted and the Michigan program underpredicted observed levels at the site. Whole

site regression between predicted and observed levels did not show a constant offset between observed and predicted levels and the correlation coefficients were poor for both programs.

Individual position data was the same except that Position 5, the near position, was predicted by both programs. The standard deviation for the differences between observed and predicted levels was large, however, for both programs.

Influencing Factors - Step-wise Regression

The multiple regression equations for this site are:

TSC: d = - 1.55901 - 0.12554 (Truck volume) + 0.00421 (Auto/truck)

Michigan: d = 2.54739 - 0.10060 (Truck volume) + 0.01756 (Distance)
- 0.00918 (Auto volume)

The Michigan program had a very good multiple correlation coefficient and a reasonable standard error of estimate. The TSC program had a good multiple correlation coefficient but a large standard error of estimate. Both programs' multiple regression standard errors of estimate were larger than those obtained from linear regression between observed and predicted levels.

The major factor influencing both programs was truck volume. Other factors influencing the predictions were almost as significant. They were the truck/auto ratio for the TSC program and auto volume for the Michigan program.

The traffic noise source variable factors probably were due to the difference in roadway alignment passing each position for this site. The roadway went from an undivided highway adjacent to Position 8 to a widely

divided highway for Position 5. The absence of distance as an influencing factor in the TSC program is probably due to the fact that barriers and woods were taken into account explicitly. This demonstrates that if the propagation path attenuation is explicitly applied, adequate results can be obtained with the TSC program.

Conclusions

The TSC program without correction should be used for this site due to the complexity of the interchange configuration. The multiple regression model cannot be used for correction because the multiple regression standard error of estimate does not meet the criteria for a valid model.

7.3.11 Comparison of TSC Prediction to Michigan Prediction Comparisons - Elementary Statistics and Regression

Considering all the sites separately, the whole site t-tests on differences between the two programs' noise levels showed significant differences in all cases except for R12 and N124. The agreement at these two sites can be attributed to the explicit consideration of noise attenuation (houses at R12 and woods at N124) in the sound propagation path for the TSC program.

The whole site sample linear regressions between the two programs' predicted noise levels demonstrated a constant offset between predicted levels at R12, N124 and N58 and no constant offset at the other sites. There was very good correlation at all sites except N58, and A9101112. The standard error of estimate was large at S123, A9101112 and N58 and generally small at the other sites.

Individual position linear regression between the two programs predicted levels generally had very good correlation and small standard errors of estimate at all sites. There was a constant offset of the programs' predicted levels for positions at R12, S123 and N58.

The regression results demonstrate that when the input data is from the same roadway, predictions from the two programs do show strong consistency with each other even if they are statistically not equal.

Influencing Factors - Step-wise Regression

The multiple correlation coefficients were very good for all sites except for A1234. The multiple regression standard error of estimate was generally small at the sites. This demonstrates little scatter about the regression planes on the data.

The multiple regression standard errors of estimate were less than the standard errors of estimate from simple linear regression between predicted levels at all sites, except C1234 and A1234. At these two sites there were significant effects from earth mound barriers.

Distance was the major variable in most cases, accounting for much of the variance in differences between the programs. The two programs do in fact have different built-in distance attenuation. The TSC program, with 3 dB per doubling of distance tends to overpredict positions far from the roadway, while the Michigan program with 4.5 dB, tended to underpredict these positions. The treatment of earth mound barriers, as indicated above for sites C1234 and A1234 also affects the distance variable.

The truck volume or truck percentage entered as a secondary factor in most cases. The volume ratios were factors at the two Route 29 sites and N58, where negligible truck traffic was the rule throughout the day.

The results point up fundamental differences in the two programs' treatment of trucks. The Michigan program truck emission levels are five decibels less than the TSC program truck emission levels.

At S123 height was a variable for Positons 1 and 2 both equidistant from the roadway. It appeared as a secondary factor influencing differences in levels for this site. A two-sample t-test revealed a significant difference in the mean differences between the two program levels at Positions 1 and 2. At R12 where height was also a variable, it did not appear as a significant factor on the differences. The fact that height was significant at S123 and not at R12 is due to distance of site positions from the road. At S123, Positions 1 and 2 were only 75 feet from the road whereas at R12, Positions 1 and 2 were 430 feet away.

Conclusions

The predictions of the Michigan program closely parallel those of the TSC program, but are significantly different. The programs still differ in the attenuation with distance and truck noise emission levels assumed. The statistical analysis of the noise site data does indeed bring out these basic differences between the programs while demonstrating their underlying consistency. In addition, the combination of truck volume and attenuation with distance of truck noise levels as factors in program differences may indicate that the truck noise source model in the programs needs refinement.

If the two programs could be made comparable or more flexible in these respects, then their results would agree more strongly for all roadway configurations. This could be attained in both programs by allowing

the input of a broad classification of trucks with different source heights and noise emission levels. In addition, a better treatment of low truck volumes should be programmed. Finally, the attenuation with distance should be dependent on traffic noise source and terrain.

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APPENDIX A

SITE DESCRIPTION

AND

NOISE MEASUREMENTS

ROUTE 29, SECTION 13A

(RESIDENTIAL)

SITE DESCRIPTION

Location

Route and Section: Route 29, Section 13A

Station or Street: Station 152+17, Berkeley Avenue

Municipality: Trenton County: Mercer

Facility: Private Residence

Sound Propagation Path Characteristics

Roadway: At-Grade

Barriers: Two Rows of Two and Three Story Houses with Raised Lawns

Terrain: Ground Slopes Down to Roadway with 1.5% Grade

Road Description

Pavement Type: Portland Cement Concrete

Pavement Quality: Normal

Number of Lanes: Near Lanes 2 Far Lanes 2

Lane Width: 12 feet

Grade: Near Lanes 0% Far Lanes 0%

Center Barrier: None

Median: Grass, 28 feet wide

SITE DESCRIPTION

Microphone Location

	Position 1	Position 2
Height of Microphone Above Ground	5'	12'
Height of Microphone with Respect to Near Lane	11'	18'
Distance to Near Lane	430'	430'

Traffic Data Collection

Traffic Counter Locations: Route 29, Northbound and Southbound

Radar Location: Not Used

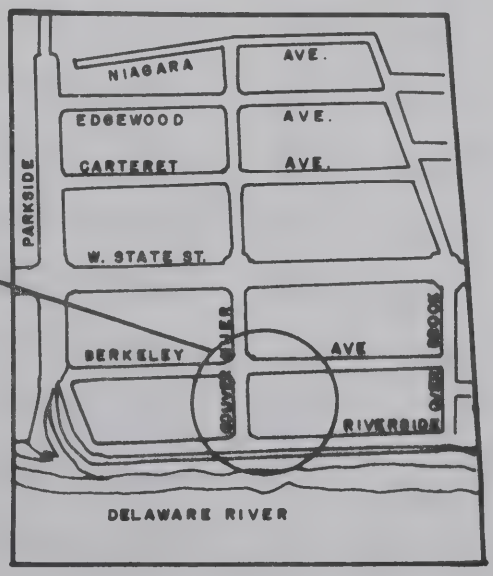
Noise Contributions from Other Sources

Light Local Traffic

Rt. 29, Section 13A
(Residential)

1" = 100'

Area Of Enlargement



NOISE MEASUREMENT DATA

ROUTE 29 SECTION 13A (RESIDENTIAL)

MICROPHONE POSITION 1

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
1200	55	10/16/73	54.9	50.2	46.3	62.9	3.8
1300	55	10/16/73	52.9	48.3	44.9	59.5	3.6
1400	55	10/16/73	55.1	49.9	45.9	61.9	3.8
1500	55	10/16/73	55.4	50.4	46.5	62.8	3.7
1600	55	10/16/73	54.6	49.2	46.0	61.6	3.6
1700	55	10/16/73	55.6	50.1	46.2	64.2	4.1
1800	0	10/16/73	NO DATA - OPERATOR ERROR				
1900	55	10/16/73	51.3	48.2	45.9	56.2	2.5
2000	55	10/16/73	50.4	46.3	42.1	59.2	3.8
2100	55	10/16/73	50.8	43.0	38.9	61.3	5.0
2200	55	10/16/73	46.5	42.8	39.9	53.9	3.4
2300	55	10/16/73	46.2	42.4	38.6	55.4	3.8
0000	55	10/17/73	48.1	42.7	37.9	56.8	4.3
0100	55	10/17/73	44.2	36.3	31.7	53.9	5.0
0200	50	10/17/73	46.4	36.5	31.7	57.5	5.7
0300	55	10/17/73	41.6	34.5	31.2	50.1	4.3
0400	50	10/17/73	45.3	34.8	31.3	58.9	5.8
0500	0	10/17/73	NO DATA - EQUIPMENT PROBLEM				
0600	55	10/17/73	48.4	43.2	39.1	56.5	4.1
0700	55	10/17/73	50.8	47.3	43.8	57.6	3.3
0800	55	10/17/73	56.1	51.7	47.4	64.1	3.8
0900	40	10/17/73	57.2	51.7	47.0	64.1	4.0
1000	55	10/17/73	54.7	49.5	45.5	62.8	4.0
1100	55	10/17/73	56.7	50.5	46.3	66.7	4.5

NOISE MEASUREMENT DATA

ROUTE 29 SECTION 13A (RESIDENTIAL)

MICROPHONE POSITION 2

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
1200	55	10/16/73	56.2	52.2	48.3	64.3	3.7
1300	55	10/16/73	55.2	50.4	46.5	61.8	3.6
1400	55	10/16/73	56.5	51.6	47.1	63.5	3.8
1500	55	10/16/73	56.5	52.3	48.3	64.3	3.7
1600	55	10/16/73	55.9	51.5	47.2	63.3	3.7
1700	55	10/16/73	56.3	51.8	47.5	64.8	3.9
1800	55	10/16/73	53.9	49.1	46.0	60.1	3.3
1900	55	10/16/73	55.9	49.2	45.5	63.4	4.2
2000	55	10/16/73	54.3	47.2	42.2	66.2	5.1
2100	55	10/16/73	52.4	45.8	41.3	62.7	4.8
2200	55	10/16/73	49.4	44.9	41.3	56.1	3.5
2300	55	10/16/73	49.0	44.2	40.7	56.9	3.7
0000	55	10/17/73	47.9	42.7	38.0	56.3	4.2
0100	55	10/17/73	45.6	38.2	32.7	55.4	5.1
0200	50	10/17/73	47.8	39.1	33.2	58.4	5.6
0300	55	10/17/73	41.4	34.2	31.1	50.5	4.2
0400	50	10/17/73	44.3	34.6	31.2	56.8	5.5
0500	50	10/17/73	45.8	40.2	35.5	56.9	4.8
0600	55	10/17/73	50.4	46.0	41.3	58.5	4.0
0700	55	10/17/73	53.9	49.2	46.0	59.9	3.3
0800	55	10/17/73	56.2	52.2	48.4	64.2	3.7
0900	40	10/17/73	56.4	51.0	46.6	63.2	3.9
1000	55	10/17/73	54.6	49.6	45.8	62.3	3.8
1100	55	10/17/73	55.4	49.1	45.6	65.0	4.4

TRAFFIC DATA

Route 29, Section 13A (Residential)

		Northbound				Southbound			
Hour	Date	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph
1200	10/16/73	568	56	-	-	564	25	-	-
1300	"	773	42	-	-	816	47	-	-
1400	"	890	43	-	-	953	43	-	-
1500	"	-	-	-	-	-	-	-	-
1600	"	1679	17	-	-	2129	20	-	-
1700	"	1599	23	-	-	1817	19	-	-
1800	"	942	15	-	-	914	18	-	-
1900	"	869	8	-	-	1025	8	-	-
2000	"	596	3	-	-	623	2	-	-
2100	"	475	2	-	-	523	1	-	-
2200	"	499	0	-	-	517	2	-	-
2300	"	415	0	-	-	456	1	-	-
0000	10/17/73	274	0	-	-	538	0	-	-
0100	"	92	1	-	-	76	0	-	-
0200	"	65	1	-	-	64	0	-	-
0300	"	32	0	-	-	42	1	-	-
0400	"	36	1	-	-	31	1	-	-
0500	"	81	0	-	-	96	0	-	-
0600	"	502	1	-	-	411	0	-	-
0700	"	1040	14	-	-	1114	9	-	-
0800	"	1551	9	-	-	2156	38	-	-
0900	"	1001	35	-	-	1203	46	-	-
1000	"	661	39	-	-	749	37	-	-
1100	"	560	58	-	-	742	33	-	-

*No radar data taken

ROUTE 29, SECTION 13A

(STACY PARK)

SITE DESCRIPTION

Location

Route and Section: Route 29, Section 13A

Station or Street: Station 168+20

Municipality: Trenton County: Mercer

Facility: Stacy Park

Sound Propagation Path Characteristics

Roadway: At-Grade

Barriers: Roadway Edge, Pedestrian Overpass

Terrain: Open Area, Mowed Grass,Occasional Trees, Ground Slopes Up from Rear Position Toward Road with Approximately 4% Grade then Plateaus for Near Positions

Road Description

Pavement Type: Portland Cement Concrete

Pavement Quality: Normal

Number of Lanes: Near Lanes 2 Far Lanes 2

Lane Width: 12 feet

Grade: Near Lanes 0% Far Lanes 0%

Center Barrier: None

Median: Grass, 28 feet wide

SITE DESCRIPTION

Microphone Location

	Position 1	Position 2	Position 3
Height of Microphone Above Ground	5'	12'	5'
Height of Microphone with Respect to Near Lane	2'	9'	-6'
Distance to Near Lane	75'	75'	150'

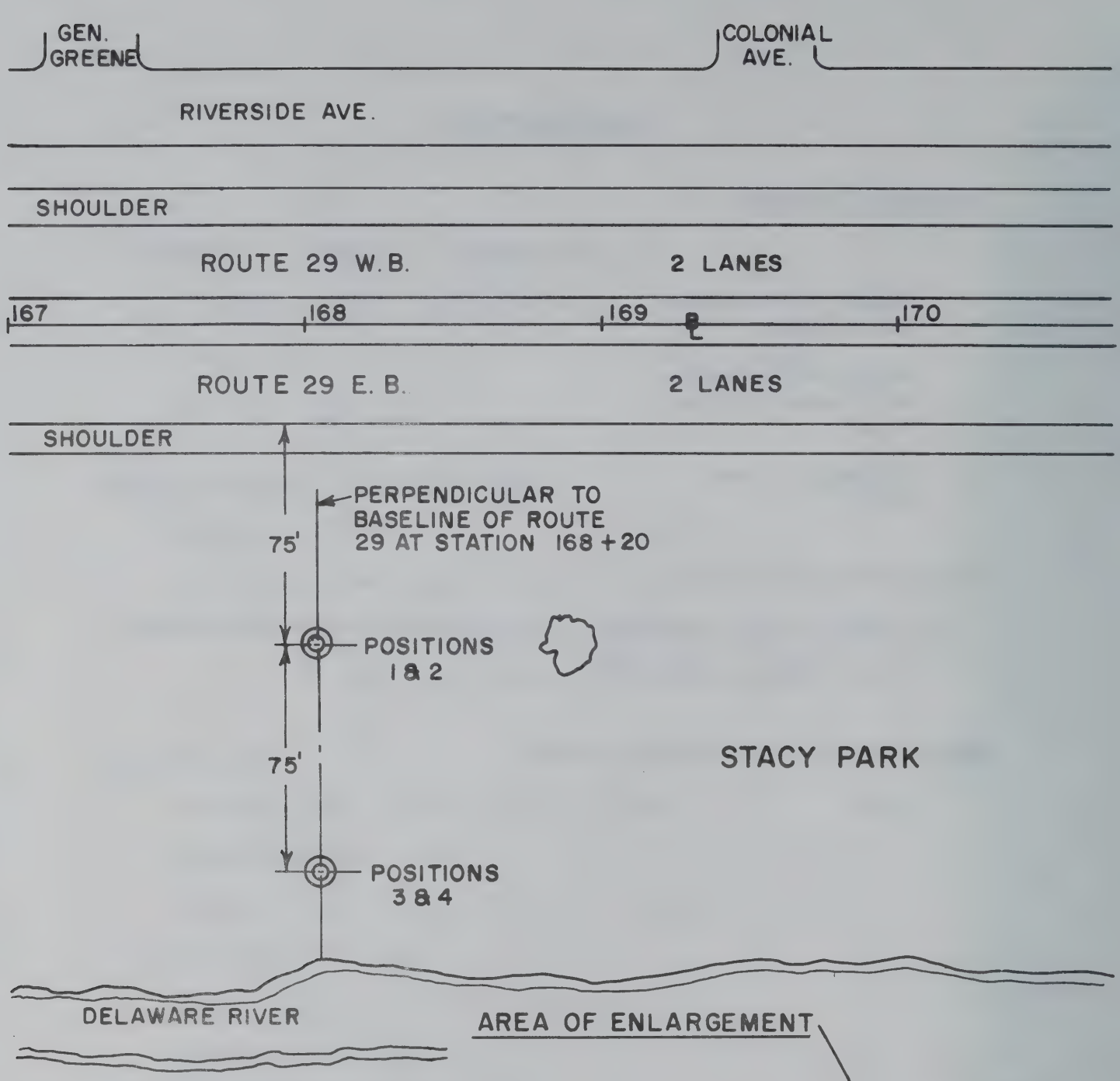
Traffic Data Collection

Traffic Counter Locations: Route 29, Northbound and Southbound

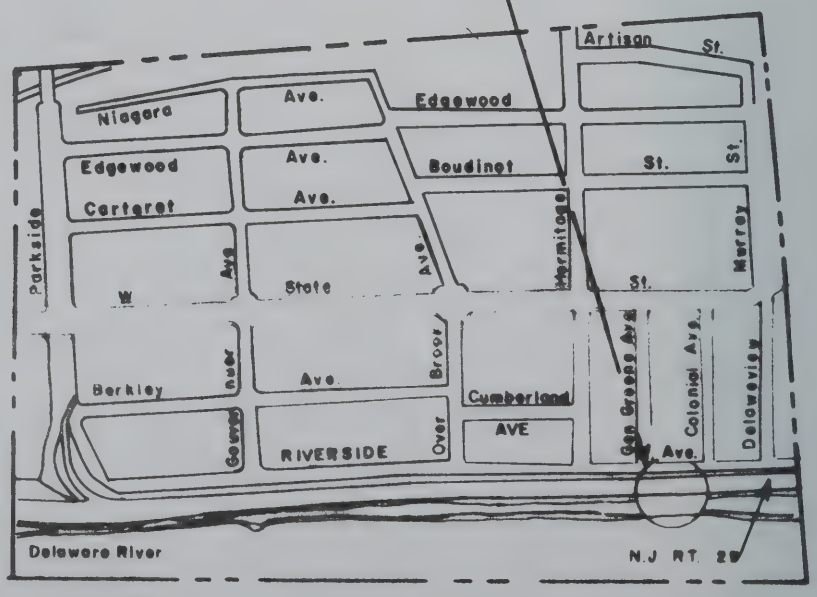
Radar Location: Not Used

Noise Contributions from Other Sources

None



AREA OF ENLARGEMENT



Route 29 Section 13A
(Stacy Park)

1" = 50'

NOISE MEASUREMENT DATA

ROUTE 29 SECTION 13A (STACY PARK)

MICROPHONE POSITION 1

HOUR ****	SAMPLE SIZE (MIN.) ****	DATE ****	L10 (DBA) *****	L50 (DBA) *****	L90 (DBA) *****	LNP (DBA) *****	STD DEV (DBA) *****
1500	45	10/18/73	69.5	65.9	61.5	76.0	3.4
1600	50	10/18/73	69.4	66.7	63.2	74.4	2.7
1700	50	10/18/73	65.1	62.7	60.5	69.7	2.3
1800	50	10/18/73	65.2	61.8	57.6	72.1	3.4
1900	42	10/18/73	64.5	61.0	56.7	70.2	3.2
2000	0	10/18/73	NO DATA - RAIN				
2100	0	10/18/73	NO DATA - MICROPHONE MALFUNCTION				
2200	50	10/18/73	64.3	60.2	55.3	70.9	3.7
2300	50	10/18/73	64.7	60.4	56.4	70.6	3.4
0000	50	10/19/73	65.0	59.4	54.5	72.6	4.2
0100	50	10/19/73	60.9	54.2	51.2	69.1	4.0
0200	50	10/19/73	58.2	53.6	51.0	64.1	3.1
0300	50	10/19/73	55.3	52.9	50.8	61.9	2.6
0400	50	10/19/73	56.6	53.2	50.9	65.2	3.3
0500	50	10/19/73	60.8	55.0	51.4	68.9	4.0
0600	50	10/19/73	66.9	62.3	57.5	75.0	4.1
0700	50	10/19/73	69.4	66.0	61.9	75.0	3.1
0800	50	10/19/73	69.4	66.4	62.6	74.5	2.8
0900	50	10/19/73	66.2	62.0	57.5	74.0	3.9
1000	50	10/19/73	65.5	61.3	56.7	73.7	3.9
1100	50	10/19/73	66.2	61.5	56.8	77.7	4.5
1200	50	10/19/73	66.0	62.0	57.6	74.0	3.8
1300	50	10/19/73	65.2	61.2	56.6	74.0	3.9
1400	50	10/19/73	64.9	60.7	56.4	73.3	3.8

NOISE MEASUREMENT DATA

ROUTE 29 SECTION 13A (STACY PARK)

MICROPHONE POSITION 2

HOUR ****	SAMPLE SIZE (MIN.) ****	DATE ****	L10 (DBA) *****	L50 (DBA) *****	L90 (DBA) *****	LNP (DBA) *****	STD DEV (DBA) *****
1500	0	10/18/73	NO DATA - EQUIPMENT PROBLEM				
1600	50	10/18/73	70.7	67.7	64.8	76.0	2.8
1700	50	10/18/73	69.4	66.5	62.4	75.2	3.1
1800	50	10/18/73	67.7	63.0	58.2	74.6	3.9
1900	0	10/18/73	NO DATA - OPERATOR ERROR				
2000	0	10/18/73	NO DATA - RAIN				
2100	45	10/18/73	65.7	60.4	54.3	74.5	4.7
2200	50	10/18/73	65.0	60.0	53.5	74.0	4.7
2300	50	10/18/73	65.6	60.1	54.2	73.9	4.5
0000	50	10/19/73	66.1	59.2	50.7	77.6	6.0
0100	50	10/19/73	60.3	49.2	42.0	75.9	7.1
0200	50	10/19/73	58.9	46.7	41.6	72.4	6.8
0300	50	10/19/73	54.8	43.7	41.0	68.6	5.8
0400	50	10/19/73	56.6	43.8	41.0	70.9	6.6
0500	50	10/19/73	61.2	51.8	40.3	78.6	8.1
0600	50	10/19/73	67.8	62.5	56.5	76.4	4.7
0700	50	10/19/73	70.1	66.6	62.3	76.5	3.4
0800	50	10/19/73	70.0	67.3	64.2	75.7	2.9
0900	50	10/19/73	67.9	62.8	57.4	75.6	4.3
1000	50	10/19/73	67.1	62.0	56.7	75.2	4.3
1100	50	10/19/73	67.9	62.4	57.2	78.5	4.7
1200	50	10/19/73	68.0	63.1	58.3	75.3	4.0
1300	50	10/19/73	67.5	62.7	57.7	75.6	4.1
1400	50	10/19/73	67.5	62.8	58.4	75.3	4.0

NOISE MEASUREMENT DATA

ROUTE 29 SECTION 13A (STACY PARK)

MICROPHONE POSITION 3

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
1500	0	10/18/73	NO DATA - EQUIPMENT PROBLEM				
1600	0	10/18/73	NO DATA - EQUIPMENT PROBLEM				
1700	0	10/18/73	NO DATA - EQUIPMENT PROBLEM				
1800	42	10/18/73	58.7	54.4	49.5	65.1	3.7
1900	43	10/18/73	58.3	54.3	51.1	62.8	2.8
2000	0	10/18/73	NO DATA - RAIN				
2100	45	10/18/73	55.5	52.5	49.5	61.4	2.9
2200	0	10/18/73	NO DATA - OPERATOR ERROR				
2300	0	10/18/73	NO DATA - OPERATOR ERROR				
0000	0	10/18/73	NO DATA - OPERATOR ERROR				
0100	50	10/18/73	44.7	42.7	40.7	48.0	1.7
0200	50	10/18/73	44.4	42.6	40.7	44.1	0.6
0300	50	10/18/73	47.6	38.9	36.5	55.5	4.4
0400	50	10/18/73	48.3	41.4	35.9	58.9	5.1
0500	0	10/18/73	NO DATA - MICROPHONE MALFUNCTION				
0600	0	10/18/73	NO DATA - MICROPHONE MALFUNCTION				
0700	50	10/18/73	50.1	47.6	45.2	54.5	2.3
0800	49	10/18/73	50.1	47.6	45.2	55.1	2.4
0900	50	10/18/73	53.0	48.6	45.6	58.5	3.1
1000	50	10/18/73	51.7	48.2	45.4	57.4	3.0
1100	50	10/18/73	53.1	48.5	45.6	63.0	3.7
1200	50	10/18/73	57.3	53.4	50.6	62.6	2.9
1300	50	10/18/73	55.8	52.7	50.0	62.5	3.0
1400	50	10/18/73	56.2	53.0	50.4	62.7	3.0

TRAFFIC DATA

Route 29, Section 13A (Stacy Park)

		Southbound				Northbound			
Hour	Date	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph
1600	10/18/74	1679	43	-	-	1842	28	-	-
1700	"	1427	17	-	-	1590	18	-	-
1800	"	806	18	-	-	1009	10	-	-
1900	"	754	1	-	-	896	12	-	-
2000	"	527	8	-	-	664	8	-	-
2100	"	481	4	-	-	574	2	-	-
2200	"	448	2	-	-	568	1	-	-
2300	"	409	3	-	-	433	3	-	-
0000	10/19/74	423	1	-	-	224	0	-	-
0100	"	93	2	-	-	123	1	-	-
0200	"	67	0	-	-	97	0	-	-
0300	"	28	1	-	-	45	1	-	-
0400	"	29	0	-	-	54	2	-	-
0500	"	70	3	-	-	104	1	-	-
0600	"	315	7	-	-	677	18	-	-
0700	"	877	23	-	-	1097	29	-	-
0800	"	1716	38	-	-	1627	46	-	-
0900	"	972	37	-	-	960	35	-	-
1000	"	667	29	-	-	795	32	-	-
1100	"	613	62	-	-	762	40	-	-
1200	"	762	38	-	-	1001	30	-	-
1300	"	773	41	-	-	917	37	-	-
1400	"	823	33	-	-	1031	34	-	-

*No radar data taken

ROUTE I-78, SECTION 2G

(CLINTON)

SITE DESCRIPTION

Location

Route and Section: Route I-78, Section 2G

Station or Street: Station 412+00

Municipality: Clinton Township County: Hunterdon

Facility: State Reformatory for Women

Sound Propagation Path Characteristics

Roadway: Depressed, Partially At-Grade

Barriers: Earth Mounds

Terrain: Grassland with Rolling Hills

Road Description

Pavement Type: Portland Cement Concrete

Pavement Quality: Normal

Number of Lanes: Near Lanes 3 Far Lanes 3

Lane Width: 12 feet

Grade: Near Lanes 1.5% Far Lanes 1.5%

Center Barrier: None

Median: Grass, 28 feet wide

SITE DESCRIPTION

Microphone Location

	Pos. 1	Pos. 2	Pos. 3	Pos. 4
Height of Microphone Above Ground	5'	5'	5'	5'
Height of Microphone with Respect to Near Lane	10'	11'	0'	-14'
Distance to Near Lane	100'	200'	400'	800'

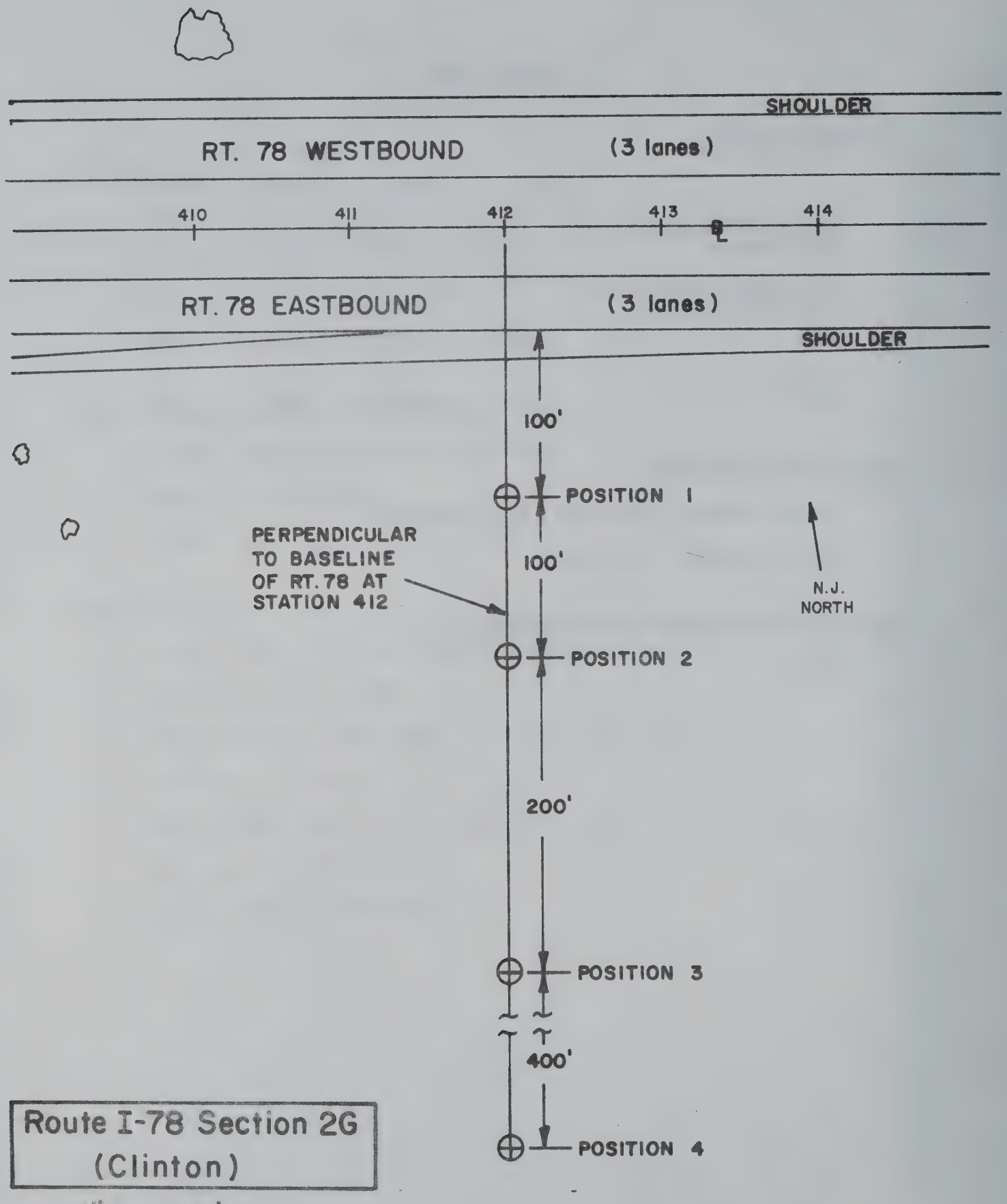
Traffic Data Collection

Traffic Counter Locations: I-78, Eastbound

Radar Location: Not Used

Noise Contributions from Other Sources

None


SHOULDER
RT. 78 WESTBOUND
(3 lanes)
410
411
412
413
414
RT. 78 EASTBOUND
(3 lanes)
SHOULDER
100'
POSITION 1
PERPENDICULAR TO BASELINE OF RT. 78 AT STATION 412
100'
N.J. NORTH
POSITION 2
200'
POSITION 3
400'
POSITION 4
Route I-78 Section 2G (Clinton)
1.2" = 100'

A-835-1

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2G (CLINTON) - DATA QUESTIONABLE, SEE SEC-5.2

MICROPHONE POSITION 1

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
****	****	****	*****	*****	*****	*****	*****
1500	0	11/01/73	NO DATA - EQUIPMENT PROBLEM				
1600	43	11/01/73	73.2	67.7	62.9	81.5	4.4
1700	43	11/01/73	72.8	66.1	61.0	82.1	4.8
1800	43	11/01/73	74.0	70.2	66.5	78.8	2.9
1900	0	11/01/73	NO DATA - NONREPRESENTATIVE NOISE				
2000	43	11/01/73	70.9	63.1	56.8	82.5	5.7
2100	43	11/01/73	70.7	62.5	55.8	83.0	6.0
2200	43	11/01/73	74.2	63.9	56.2	88.3	7.0
2300	43	11/01/73	72.4	62.0	54.3	86.8	7.1
0000	43	11/02/73	72.9	61.1	51.6	89.0	7.9
0100	43	11/02/73	72.5	61.2	51.0	89.0	8.1
0200	0	11/02/73	NO DATA - MICROPHONE MALFUNCTION				
0300	0	11/02/73	NO DATA - MICROPHONE MALFUNCTION				
0400	0	11/02/73	NO DATA - MICROPHONE MALFUNCTION				
0500	0	11/02/73	NO DATA - EQUIPMENT PROBLEM				
0600	0	11/02/73	NO DATA - EQUIPMENT PROBLEM				
0700	0	11/02/73	NO DATA - EQUIPMENT PROBLEM				
0800	45	11/02/73	71.8	65.1	58.2	81.3	5.2
0900	45	11/02/73	72.0	64.2	57.3	83.2	5.8
1000	45	11/02/73	73.1	64.2	57.2	85.0	6.2
1100	45	11/02/73	71.9	63.7	56.7	83.4	5.9
1200	45	11/02/73	70.8	63.2	57.1	81.0	5.4
1300	45	11/02/73	71.9	64.7	58.7	81.9	5.3
1400	45	11/02/73	71.0	64.0	57.7	81.1	5.3

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2G (CLINTON) - DATA QUESTIONABLE, SEE SEC-5.2

MICROPHONE POSITION 2

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
1500	0	11/01/73	NO DATA - EQUIPMENT PROBLEM				
1600	43	11/01/73	71.0	66.6	61.9	78.1	3.8
1700	43	11/01/73	68.9	62.8	57.8	77.3	4.5
1800	0	11/01/73	NO DATA - EQUIPMENT PROBLEM				
1900	43	11/01/73	70.0	64.1	58.7	78.9	4.7
2000	43	11/01/73	69.6	61.9	56.1	80.1	5.4
2100	43	11/01/73	70.8	63.2	56.9	81.7	5.5
2200	43	11/01/73	70.7	61.1	53.9	83.0	6.5
2300	43	11/01/73	68.3	58.9	51.5	80.9	6.5
0000	0	11/02/73	NO DATA - EQUIPMENT PROBLEM				
0100	0	11/02/73	NO DATA - EQUIPMENT PROBLEM				
0200	43	11/02/73	71.0	60.9	52.1	85.3	7.2
0300	43	11/02/73	73.3	66.3	56.6	86.2	6.5
0400	43	11/02/73	77.2	68.5	60.1	90.1	6.6
0500	43	11/02/73	76.0	68.3	59.6	87.9	6.2
0600	43	11/02/73	76.5	68.8	62.3	86.7	5.5
0700	32	11/02/73	72.7	65.7	60.5	81.4	4.8
0800	45	11/02/73	73.2	65.4	58.1	84.0	5.7
0900	45	11/02/73	71.2	63.9	57.1	81.7	5.5
1000	45	11/02/73	67.3	59.8	53.0	78.2	5.6
1100	45	11/02/73	67.4	60.3	54.1	77.3	5.2
1200	45	11/02/73	65.0	58.3	52.8	74.2	4.9
1300	45	11/02/73	67.3	60.8	55.2	76.9	5.0
1400	45	11/02/73	70.0	63.6	57.5	79.3	5.0

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2G (CLINTON) - DATA QUESTIONABLE, SEE SEC-5.2

MICROPHONE POSITION 3

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
****	****	****	*****	*****	*****	*****	*****
1500	40	11/01/73	73.6	68.3	63.7	80.6	4.0
1600	43	11/01/73	71.6	66.6	61.7	78.8	4.0
1700	43	11/01/73	69.4	63.9	59.2	76.8	4.2
1800	43	11/01/73	69.5	64.0	58.8	77.2	4.3
1900	43	11/01/73	69.7	64.0	58.5	77.8	4.5
2000	43	11/01/73	67.5	61.0	55.7	76.2	4.7
2100	43	11/01/73	67.9	61.9	56.5	76.8	4.6
2200	43	11/01/73	69.6	61.5	54.9	80.3	5.7
2300	43	11/01/73	67.5	60.2	53.1	78.5	5.7
0000	43	11/02/73	68.1	59.9	52.1	79.9	6.2
0100	43	11/02/73	68.2	59.8	53.0	79.3	5.9
0200	43	11/02/73	70.0	61.7	53.9	81.9	6.2
0300	43	11/02/73	70.2	62.6	55.0	81.0	5.8
0400	43	11/02/73	71.3	64.1	57.0	81.3	5.5
0500	43	11/02/73	72.3	65.8	58.7	81.8	5.2
0600	43	11/02/73	71.6	64.8	59.6	79.9	4.7
0700	43	11/02/73	68.6	62.8	57.8	76.3	4.3
0800	43	11/02/73	67.2	61.4	56.4	74.6	4.2
0900	43	11/02/73	66.5	59.6	53.2	76.1	5.2
1000	43	11/02/73	65.6	58.5	52.5	75.3	5.1
1100	43	11/02/73	63.7	57.7	52.6	72.1	4.5
1200	43	11/02/73	64.9	58.9	55.6	71.1	3.8
1300	43	11/02/73	67.0	61.8	56.5	75.2	4.3
1400	43	11/02/73	64.7	59.1	53.9	73.1	4.5

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2G (CLINTON) - DATA QUESTIONABLE, SEE SEC-5.2

MICROPHONE POSITION 4

HOUR ****	SAMPLE SIZE (MIN.) ****	DATE ****	L10 (DBA) *****	L50 (DBA) *****	L90 (DBA) *****	LNP (DBA) *****	STD DEV (DBA) *****
1500	40	11/01/73	70.0	67.1	62.6	77.3	3.7
1600	43	11/01/73	66.3	61.7	57.3	72.8	3.6
1700	43	11/01/73	63.6	58.9	55.3	69.7	3.5
1800	43	11/01/73	64.2	59.6	55.7	70.3	3.5
1900	43	11/01/73	64.4	60.0	55.8	70.8	3.6
2000	43	11/01/73	64.3	59.3	55.4	70.8	3.7
2100	43	11/01/73	61.2	56.1	51.4	68.2	3.9
2200	43	11/01/73	62.4	55.9	51.0	70.5	4.5
2300	43	11/01/73	61.8	56.1	50.2	69.6	4.5
0000	43	11/02/73	61.7	55.2	49.2	70.6	4.9
0100	43	11/02/73	60.4	53.9	47.6	70.1	5.0
0200	43	11/02/73	63.2	57.3	47.2	75.1	6.0
0300	43	11/02/73	63.7	54.5	50.8	72.3	5.0
0400	43	11/02/73	64.8	59.5	53.7	73.6	4.7
0500	43	11/02/73	66.6	61.3	55.4	74.8	4.5
0600	43	11/02/73	64.8	59.4	55.0	71.9	4.0
0700	43	11/02/73	63.0	57.9	53.4	69.8	3.9
0800	43	11/02/73	61.4	56.8	51.9	68.0	3.8
0900	43	11/02/73	59.7	54.2	47.7	68.3	4.7
1000	43	11/02/73	59.2	52.9	47.0	68.5	4.9
1100	43	11/02/73	59.1	54.1	49.6	66.2	3.9
1200	43	11/02/73	59.0	54.5	50.7	65.0	3.4
1300	43	11/02/73	62.5	58.0	53.9	68.8	3.6
1400	43	11/02/73	60.7	56.0	51.3	67.7	3.9

TRAFFIC DATA

Route I-78, Section 2G (Clinton)

		Eastbound				Westbound			
Hour	Date	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph
1600	11/01/73	552	113	-	-	849	191	-	-
1700	"	473	100	-	-	931	155	-	-
1800	"	386	89	-	-	464	159	-	-
1900	"	298	65	-	-	374	191	-	-
2000	"	192	67	-	-	247	93	-	-
2100	"	211	56	-	-	305	98	-	-
2200	"	176	112	-	-	245	77	-	-
2300	"	145	108	-	-	237	88	-	-
0000	11/02/73	61	137	-	-	122	68	-	-
0100	"	41	129	-	-	73	85	-	-
0200	"	17	151	-	-	39	83	-	-
0300	"	28	181	-	-	24	97	-	-
0400	"	28	270	-	-	25	87	-	-
0500	"	101	290	-	-	61	106	-	-
0600	"	481	236	-	-	128	142	-	-
0700	"	1068	264	-	-	378	170	-	-
0800	"	652	268	-	-	346	178	-	-
0900	"	438	189	-	-	456	221	-	-
1000	"	443	240	-	-	354	243	-	-
1100	"	451	209	-	-	471	297	-	-
1200	"	371	156	-	-	336	240	-	-
1300	"	670	186	-	-	414	280	-	-
1400	"	711	194	-	-	398	195	-	-

*No radar data taken

WEATHER DATA

Route I-78, Section 2G (Clinton)

Hour	Date	Wind Speed Mph	Wind Direction Degree	Temperature °F
1500	11/01/73	25	262	56
1600	11/01/73	25	275	52.5
1700	11/01/73	20	262	50
1800	11/01/73	15	289	48
1900	11/01/73	18	278	51
2000	11/01/73	20	272	50
2100	11/01/73	7	280	47.5
2200	11/01/73	12	322	48
2300	11/01/73	8	280	47
0000	11/02/73	5	262	45.5
0100	11/02/73	0-3	276	44
0200	11/02/73	0-3	276	38
0300	11/02/73	0-3	296	38
0400	11/02/73	0-3	296	40
0500	11/02/73	0-3	296	38.5
0600	11/02/73	0-3	290	38
0700	11/02/73	0-3	288	38
0800	11/02/73	0-3	266	40
0900	11/02/73	0-3	250	56
1000	11/02/73	0-3	270	57

WEATHER DATA

Route I-78, Section 2G (Clinton)

Hour	Date	Wind Speed Mph	Wind Direction Degree	Temperature ^{o}F
1100	11/02/73	0-3	270	58.5
1200	11/02/73	0-3	286	60.5
1300	11/02/73	0-3	270	62.5
1400	11/02/73	5	251	65.5

ROUTE I-78, SECTION 2M AND 3E

(ANNANDALE)

SITE DESCRIPTION

Location

Route and Section: Route I-78, Section 2M and 3E

Station or Street: Station 127+00

Municipality: Clinton Township County: Hunterdon

Facility: Annandale Correctional Institute

Sound Propagation Path Characteristics

Roadway: Depressed

Barriers: Earth Mound

Terrain: Open Fields, Grassy Rolling Hills

Road Description

Pavement Type: Portland Cement Concrete

Pavement Quality: Normal

Number of Lanes: Near Lanes 3 Far Lanes 3

Lane Width: 12 feet

Grade: Near Lanes 2% Far Lanes 2%

Center Barrier: None

Median: Grass, 50 feet wide

SITE DESCRIPTION

Microphone Location

	Pos. 1	Pos. 2	Pos. 3	Pos. 4
Height of Microphone Above Ground	5'	5'	5'	5'
Height of Microphone with Respect to Near Lane	51'	50'	36'	19'
Distance to Near Lane	112'	212'	415'	812'

Traffic Data Collection

Traffic Counter Locations: I-78, Eastbound and Westbound

Radar Location: I-78 (for position 4 only)

Noise Contributions from Other Sources

Light Traffic on Petticoat Lane

SITE DESCRIPTION

Location

Route and Section: Route I-78, Section 2M and 3G

Station or Street: Station 121+25

Municipality: Clinton Township County: Hunterdon

Facility: Annandale Correctional Institution

Sound Propagation Path Characteristics

Roadway: Transition between Elevated and Depressed Roadway Configurations

Barriers: Earth Mounds

Terrain: Open Fields, Grassy Rolling Hills

Road Description

Pavement Type: Portland Cement Concrete

Pavement Quality: Normal

Number of Lanes: Near Lanes 3 Far Lanes 3

Lane Width: 12 feet

Grade: Near Lanes 2.5% Far Lanes 2.5%

Center Barrier: None

Median: Grass, 50 feet wide

SITE DESCRIPTION

Microphone Location

	Pos. 5	Pos. 6	Pos. 7	Pos. 8
Height of Microphone Above Ground	5'	5'	5'	5'
Height of Microphone with Respect to Near Lane	5'	9'	5'	0'
Distance to Near Lane	99'	199'	403'	784'

Traffic Data Collection

Traffic Counter Locations: I-78, Westbound and Eastbound

Radar Location: I-78 (for position 8 only)

Noise Contributions from Other Sources

None

SITE DESCRIPTION

Location

Route and Section: Route I-78, Section 2M and 3E

Station or Street: Station 116+50

Municipality: Clinton Township County: Hunterdon

Facility: Annandale Correctional Institution

Sound Propgation Path Characteristics

Roadway: Elevated

Barriers: Edge of Roadway

Terrain: Open Field, Grass and Bare Earth

Road Description

Pavement Type: Portland Cement Concrete

Pavement Quality: Normal

Number of Lanes: Near Lanes 3 Far Lanes 3

Lane Width: 12 feet

Grade: Near Lanes 7.6% Far Lanes 2.7%

Center Barrier: None

Median: Grass, 50 feet wide Median Width: 50 feet

SITE DESCRIPTION

Microphone Location

	Pos. 9	Pos. 10	Pos. 11	Pos. 12
Height of Microphone Above Ground	5'	5'	5'	5'
Height of Microphone with Respect to Near Lane	-27'	-37'	-29'	-29'
Distance to Near Lane	98'	198'	413'	758'

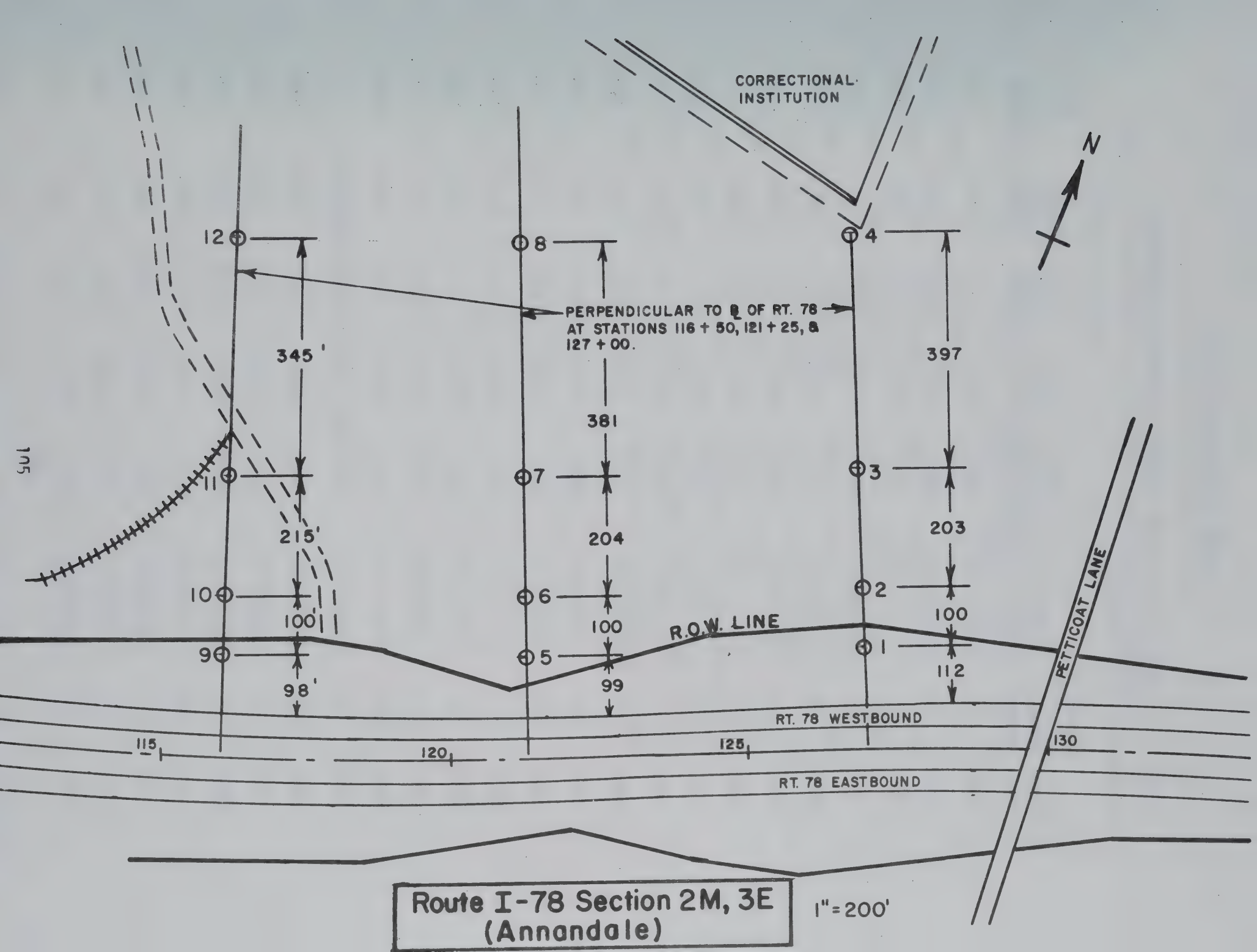
Traffic Data Collection

Traffic Counter Locations: I-78, Westbound and Eastbound

Radar Location: I-78 (for position 12 only)

Noise Contributions from Other Sources

Occasional Train


CORRECTIONAL INSTITUTION
N
PERPENDICULAR TO ℄ OF RT. 78 AT STATIONS 116 + 50, 121 + 25, & 127 + 00.
12
11
10
9
8
7
6
5
4
3
2
1
345'
215'
100'
98'
381
204
100
99
397
203
100
112
R.O.W. LINE
PETTICOAT LANE
RT. 78 WESTBOUND
RT. 78 EASTBOUND
115
120
125
130
105
Route I-78 Section 2M, 3E
(Annandale)
1" = 200'

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2M & 3E STATION 127+00 (ANNANDALE)

MICROPHONE POSITION 1

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
1600	30	12/04/73	80.2	73.8	67.2	89.9	5.1
1700	45	12/04/73	80.1	73.5	66.9	90.1	5.3
1800	45	12/04/73	78.2	70.2	63.1	89.2	5.9
1900	45	12/04/73	78.8	69.8	61.5	91.5	6.6
2000	45	12/04/73	77.7	68.3	59.9	90.9	6.9
2100	45	12/04/73	76.8	66.5	59.1	92.2	7.2
2200	30	12/04/73	77.0	68.1	60.7	89.1	6.3
2300	45	12/04/73	79.5	70.6	61.5	93.5	7.1
0000	45	12/05/73	78.2	69.9	62.3	89.9	6.2
1400	45	12/06/73	80.4	73.1	64.4	92.6	6.3
1500	45	12/06/73	80.5	73.4	64.4	93.1	6.4
1600	45	12/06/73	82.2	75.0	66.7	94.9	6.4
1700	45	12/06/73	77.3	69.6	61.6	88.9	6.1
1800	45	12/06/73	78.4	70.8	62.9	90.0	6.1
1900	45	12/06/73	79.1	70.5	59.1	94.9	7.6
2000	45	12/06/73	77.2	67.9	55.8	94.3	8.3
2100	0	12/06/73	NO DATA - EQUIPMENT PROBLEM				
2200	45	12/06/73	76.6	67.5	54.9	93.6	8.3
2300	45	12/06/73	76.1	68.9	55.4	93.1	8.2
0000	45	12/07/73	75.4	66.8	52.0	93.8	8.8
0100	45	12/07/73	75.8	66.7	53.1	93.9	8.7
0200	45	12/07/73	77.2	69.0	55.8	94.2	8.2
0300	45	12/07/73	73.7	67.6	55.7	87.5	6.9
0400	45	12/07/73	81.1	75.1	61.6	96.4	7.4

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2M & 3E STATION 127+00 (ANNANDALE)

MICROPHONE POSITION 1

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
0500	45	12/07/73	77.9	71.9	60.2	91.2	6.6
0600	45	12/07/73	80.8	75.6	68.4	90.2	4.9
0700	45	12/07/73	79.7	74.6	68.3	88.5	4.7
0800	45	12/07/73	79.7	73.5	65.9	90.6	5.7
0900	45	12/07/73	81.5	75.2	66.5	93.7	6.1
1000	45	12/07/73	81.2	74.9	65.6	93.7	6.3
1100	0	12/07/73	NO DATA - EQUIPMENT PROBLEM				
1200	0	12/07/73	NO DATA - EQUIPMENT PROBLEM				
1300	0	12/07/73	NO DATA - EQUIPMENT PROBLEM				

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2M & 3E STATION 127+00 (ANNANDALE)

MICROPHONE POSITION 2

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
****	****	****	*****	*****	*****	*****	*****
1600	45	12/11/73	60.0	56.8	53.1	65.2	2.9
1700	45	12/11/73	59.6	55.9	51.9	64.8	3.0
1800	45	12/11/73	60.0	56.1	51.8	66.5	3.4
1900	45	12/11/73	59.4	53.8	48.7	67.8	4.4
2000	45	12/11/73	59.6	54.6	50.3	66.7	3.9
2100	45	12/11/73	58.9	53.3	48.3	66.5	4.3
2200	0	12/11/73	NO DATA - OPERATOR ERROR				
2300	0	12/11/73	NO DATA - OPERATOR ERROR				
0000	0	12/12/73	NO DATA - OPERATOR ERROR				
0100	45	12/12/73	62.4	56.5	49.8	83.4	5.9
0200	45	12/12/73	61.6	56.4	49.6	70.9	4.9
0300	45	12/12/73	63.9	58.5	52.7	72.3	4.6
0400	45	12/12/73	63.4	57.8	53.0	71.5	4.4
0500	45	12/12/73	61.9	57.8	53.9	68.0	3.4
0600	0	12/12/73	NO DATA - OPERATOR ERROR				
0700	45	12/12/73	65.7	62.2	52.1	76.0	5.0
0800	45	12/12/73	62.3	57.9	54.2	68.5	3.5
0900	45	12/12/73	63.3	58.6	54.4	69.8	3.7
1000	45	12/12/73	64.6	60.0	55.6	72.4	4.0
1100	45	12/12/73	63.7	58.8	54.2	71.2	4.0
1200	45	12/12/73	61.6	57.4	53.2	68.2	3.5
1300	45	12/12/73	62.4	56.6	51.6	71.1	4.4
1400	45	12/12/73	62.5	57.6	52.8	69.6	3.9
1500	45	12/12/73	60.6	56.2	51.9	67.9	3.7

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2M & 3E STATION 127+00 (ANNANDALE)

MICROPHONE POSITION 3

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
1400	0	01/29/74	NO DATA - EQUIPMENT PROBLEM				
1500	0	01/29/74	NO DATA - EQUIPMENT PROBLEM				
1600	0	01/29/74	NO DATA - EQUIPMENT PROBLEM				
1700	0	01/29/74	NO DATA - EQUIPMENT PROBLEM				
1800	0	01/29/74	NO DATA - EQUIPMENT PROBLEM				
1900	0	01/29/74	NO DATA - EQUIPMENT PROBLEM				
2000	45	01/29/74	59.7	54.3	49.3	68.0	4.4
2100	30	01/29/74	59.9	55.7	51.3	67.1	3.8
2200	45	01/29/74	61.0	56.8	52.3	67.4	3.6
2300	45	01/29/74	62.2	56.1	51.3	70.8	4.5
0000	45	01/30/74	62.3	56.6	51.4	70.8	4.5
0100	45	01/30/74	63.9	57.7	51.0	74.0	5.3
0200	45	01/30/74	64.2	58.2	50.6	74.9	5.5
0300	45	01/30/74	62.9	56.8	51.3	71.5	4.7
0400	45	01/30/74	62.5	57.4	52.3	69.9	4.2
0500	45	01/30/74	63.0	57.9	53.2	71.1	4.3
0600	45	01/30/74	63.1	58.3	53.7	70.1	3.9
0700	45	01/30/74	60.9	57.5	54.1	67.9	3.5
0800	45	01/30/74	60.6	57.9	55.4	65.9	2.7
0900	0	01/30/74	NO DATA - EQUIPMENT PROBLEM				
1000	0	01/30/74	NO DATA - EQUIPMENT PROBLEM				
1100	0	01/30/74	NO DATA - EQUIPMENT PROBLEM				
1200	0	01/30/74	NO DATA - EQUIPMENT PROBLEM				
1300	0	01/30/74	NO DATA - EQUIPMENT PROBLEM				

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2M & 3E STATION 127+00 (ANNANDALE)

MICROPHONE POSITION 4

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
1200	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
1300	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
1400	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
1500	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
1600	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
1700	45	02/28/74	56.9	53.5	51.0	60.8	2.4
1800	45	02/28/74	54.9	52.7	50.7	57.2	1.5
1900	45	02/28/74	60.6	58.3	56.3	63.8	1.9
2000	45	02/28/74	59.6	57.6	55.7	60.5	1.0
2100	0	02/28/74	NO DATA - OPERATOR ERROR				
2200	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
2300	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
0000	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
0100	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
0200	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
0300	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
0400	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
0500	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
0600	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
0700	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
0800	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
0900	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
1000	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
1100	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2M & 3E STATION 127+00 (ANNANDALE)

MICROPHONE POSITION 4

HOUR ****	SAMPLE SIZE (MIN.) ****	DATE ****	L10 (DBA) *****	L50 (DBA) *****	L90 (DBA) *****	LNP (DBA) *****	STD DEV (DBA) *****
1200	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
1300	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
1400	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
1500	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
1600	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
1700	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2M & 3E STATION 121+25 (ANNANDALE)

MICROPHONE POSITION 5

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
****	****	****	*****	*****	*****	*****	*****
1700	0	12/04/73	NO DATA - MICROPHONE MALFUNCTION				
1800	0	12/04/73	NO DATA - MICROPHONE MALFUNCTION				
1900	0	12/04/73	NO DATA - MICROPHONE MALFUNCTION				
2000	0	12/04/73	NO DATA - MICROPHONE MALFUNCTION				
2100	45	12/04/73	69.0	56.8	49.1	85.2	7.6
2200	0	12/04/73	NO DATA - MICROPHONE MALFUNCTION				
2300	0	12/04/73	NO DATA - MICROPHONE MALFUNCTION				
0000	45	12/05/73	61.4	55.6	50.6	69.9	4.5
1400	45	12/06/73	72.9	64.7	58.3	84.2	5.8
1500	0	12/06/73	NO DATA - MICROPHONE MALFUNCTION				
1600	45	12/06/73	70.3	62.2	54.9	82.2	6.0
1700	45	12/06/73	72.1	64.2	58.7	82.4	5.4
1800	45	12/06/73	71.7	63.3	57.4	82.7	5.7
1900	45	12/06/73	70.3	61.6	55.3	82.5	6.0
2000	45	12/06/73	70.4	61.8	53.6	83.6	6.4
2100	45	12/06/73	68.9	59.4	52.0	82.0	6.6
2200	45	12/06/73	67.6	59.7	51.9	80.4	6.2
2300	45	12/06/73	67.8	60.5	53.7	81.0	5.9
0000	45	12/07/73	66.8	58.7	50.7	80.8	6.5
0100	45	12/07/73	68.5	59.3	52.2	81.8	6.4
0200	45	12/07/73	68.7	60.7	53.5	80.6	6.0
0300	45	12/07/73	69.0	62.2	56.1	78.8	5.2
0400	45	12/07/73	73.3	66.2	57.5	86.6	6.5
0500	32	12/07/73	73.0	65.7	56.3	87.4	6.9

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2M & 3E STATION 121+25 (ANNANDALE)

MICROPHONE POSITION 5

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
0600	20	12/07/73	72.0	65.1	58.5	83.6	5.7
0700	45	12/07/73	73.6	66.4	60.2	83.9	5.3
0800	45	12/07/73	69.7	61.3	55.5	80.5	5.6
0900	45	12/07/73	72.1	64.1	58.5	81.8	5.3
1000	45	12/07/73	71.7	62.5	55.7	83.7	6.1
1100	45	12/07/73	72.2	62.8	55.3	85.0	6.5
1200	45	12/07/73	71.2	61.7	54.6	83.5	6.4
1300	45	12/07/73	73.6	62.9	55.4	87.1	6.9

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2M & 3E STATION 121+25 (ANNANDALE)

MICROPHONE POSITION 6

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
****	****	****	*****	*****	*****	*****	*****
1600	45	12/11/73	69.1	61.0	57.0	76.8	4.4
1700	45	12/11/73	67.3	58.9	53.8	77.5	5.4
1800	45	12/11/73	67.9	59.1	53.2	79.0	5.7
1900	45	12/11/73	66.5	56.7	49.8	79.6	6.5
2000	45	12/11/73	62.6	53.6	50.2	71.1	4.9
2100	0	12/11/73	NO DATA - EQUIPMENT PROBLEM				
2200	0	12/11/73	NO DATA - EQUIPMENT PROBLEM				
2300	0	12/11/73	NO DATA - EQUIPMENT PROBLEM				
0000	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
0100	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
0200	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
0300	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
0400	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
0500	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
0600	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
0700	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
0800	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
0900	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
1000	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
1100	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
1200	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
1300	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
1400	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
1500	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2M & 3E STATION 121+25 (ANNANDALE)

MICROPHONE POSITION 7

HOUR ****	SAMPLE SIZE (MIN.) ****	DATE ****	L10 (DBA) *****	L50 (DBA) *****	L90 (DBA) *****	LNP (DBA) *****	STD DEV (DBA) *****
1400	45	01/29/74	61.9	54.9	47.8	72.2	5.5
1500	45	01/29/74	64.9	57.0	50.8	75.3	5.5
1600	45	01/29/74	63.1	56.9	50.7	72.1	4.9
1700	45	01/29/74	64.2	57.9	52.0	73.1	4.8
1800	45	01/29/74	62.9	56.1	50.7	71.4	4.8
1900	0	01/29/74	NO DATA - EQUIPMENT PROBLEM				
2000	45	01/29/74	63.6	55.7	48.5	75.2	5.9
2100	30	01/29/74	63.7	57.0	51.1	72.8	5.0
2200	45	01/29/74	64.5	59.2	53.8	72.3	4.3
2300	0	01/29/74	NO DATA - MICROPHONE MALFUNCTION				
0000	45	01/30/74	63.6	55.3	47.7	75.4	6.1
0100	45	01/30/74	64.5	57.5	49.0	75.5	5.8
0200	0	01/30/74	NO DATA - EQUIPMENT PROBLEM				
0300	45	01/30/74	65.1	58.0	50.2	76.2	5.7
0400	45	01/30/74	63.3	56.6	48.8	74.1	5.5
0500	45	01/30/74	66.8	61.1	54.3	75.3	4.8
0600	45	01/30/74	64.1	57.7	51.4	73.6	5.0
0700	45	01/30/74	64.6	59.3	53.4	72.6	4.4
0800	45	01/30/74	66.0	61.4	56.5	72.6	3.8
0900	45	01/30/74	65.3	60.9	56.0	72.3	3.8
1000	45	01/30/74	65.0	59.6	55.0	73.1	4.3
1100	45	01/30/74	66.2	61.2	55.3	74.3	4.4
1200	45	01/30/74	67.2	60.4	53.8	77.4	5.3
1300	0	01/30/74	NO DATA - EQUIPMENT PROBLEM				

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2M & 3E STATION 121+25 (ANNANDALE)

MICROPHONE POSITION 8

HOUR ****	SAMPLE SIZE (MIN.) ****	DATE ****	L10 (DBA) *****	L50 (DBA) *****	L90 (DBA) *****	LNP (DBA) *****	STD DEV (DBA) *****
1200	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
1300	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
1400	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
1500	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
1600	45	02/28/74	62.8	57.1	52.3	80.2	5.5
1700	45	02/28/74	63.4	57.9	52.7	78.6	5.2
1800	0	02/28/74	NO DATA - OPERATOR ERROR				
1900	45	02/28/74	60.4	54.8	48.8	68.9	4.6
2000	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
2100	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
2200	45	02/28/74	58.4	53.6	47.9	66.2	4.2
2300	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
0000	45	03/01/74	60.3	56.1	50.5	67.7	4.0
0100	45	03/01/74	62.2	57.5	53.1	69.8	4.0
0200	45	03/01/74	63.3	57.5	51.9	71.0	4.4
0300	45	03/01/74	62.5	57.6	52.7	69.9	4.1
0400	45	03/01/74	64.0	60.2	56.2	69.1	3.1
0500	45	03/01/74	59.3	54.0	49.7	66.4	4.0
0600	45	03/01/74	62.2	57.3	52.5	70.2	4.2
0700	45	03/01/74	60.4	56.5	52.2	76.7	4.4
0800	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
0900	45	03/01/74	61.2	56.9	52.4	67.6	3.6
1000	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
1100	45	03/01/74	61.5	57.5	53.8	68.1	3.5

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2M & 3E STATION 121+25 (ANNANDALE)

MICROPHONE POSITION 8

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
1200	45	03/01/74	60.9	56.8	52.4	67.8	3.6
1300	45	03/01/74	66.5	58.4	51.1	78.7	6.1
1400	45	03/01/74	61.1	55.8	51.2	68.5	4.0
1500	45	03/01/74	60.7	56.2	51.8	67.8	3.7
1600	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				
1700	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2M & 3E STATION 116+50 (ANNANDALE)

MICROPHONE POSITION 9

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
1600	30	12/04/73	67.2	62.9	59.3	73.2	3.4
1700	30	12/04/73	66.6	60.2	55.0	75.2	4.6
1800	45	12/04/73	67.6	61.4	55.4	76.2	4.8
1900	45	12/04/73	65.7	58.6	52.0	76.1	5.4
2000	30	12/04/73	65.4	62.9	51.4	76.9	5.2
2100	45	12/04/73	65.0	55.7	48.9	76.8	6.1
2200	0	12/04/73	NC DATA - EQUIPMENT PROBLEM				
2300	33	12/04/73	65.5	57.7	51.5	75.8	5.5
0000	0	12/05/73	NO DATA - RAIN				
1400	45	12/06/73	65.9	59.5	56.2	73.3	4.0
1500	45	12/06/73	65.2	59.2	53.1	74.2	4.8
1600	45	12/06/73	64.7	58.7	52.6	73.8	4.8
1700	45	12/06/73	65.3	59.6	54.5	73.5	4.4
1800	45	12/06/73	64.2	58.1	52.7	73.2	4.7
1900	45	12/06/73	64.6	57.1	51.7	74.7	5.2
2000	45	12/06/73	65.2	58.1	51.7	75.4	5.3
2100	45	12/06/73	64.8	56.7	50.2	77.9	6.1
2200	45	12/06/73	60.4	54.9	49.3	69.1	4.5
2300	45	12/06/73	61.9	56.2	50.5	70.7	4.6
0000	45	12/07/73	61.2	53.9	48.3	75.1	5.7
0100	45	12/07/73	61.3	54.3	48.7	71.1	5.0
0200	45	12/07/73	58.9	51.9	47.3	67.0	4.6
0300	45	12/07/73	63.5	58.2	53.3	71.1	4.2
0400	45	12/07/73	66.4	60.8	55.4	74.8	4.5

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2W & 3E STATION 116+50 (ANNANDALE)

MICROPHONE POSITION 5

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
0500	45	12/07/73	65.5	60.3	54.5	73.9	4.4
0600	20	12/07/73	65.0	60.4	54.6	74.3	4.5
0700	45	12/07/73	64.0	58.2	53.2	74.6	4.6
0800	45	12/07/73	61.2	55.1	50.6	68.8	4.3
0900	45	12/07/73	63.9	58.4	52.3	72.8	4.7
1000	45	12/07/73	62.7	57.2	51.9	71.2	4.5
1100	45	12/07/73	63.0	56.3	50.6	72.3	5.0
1200	45	12/07/73	62.9	56.6	51.1	71.8	4.7
1300	45	12/07/73	63.1	54.3	47.7	74.7	6.0

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2W & 3E STATION 116+50 (ANNANDALE)

MICROPHONE POSITION 10

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
1600	45	12/11/73	64.5	58.1	52.1	74.1	4.9
1700	45	12/11/73	63.7	56.2	51.0	73.4	5.1
1800	45	12/11/73	64.7	57.2	51.3	75.1	5.3
1900	45	12/11/73	63.9	54.2	48.3	76.6	6.2
2000	45	12/11/73	63.9	55.4	49.1	75.2	5.8
2100	45	12/11/73	63.7	53.5	47.4	76.4	6.4
2200	45	12/11/73	62.2	53.7	48.0	72.7	5.5
2300	45	12/11/73	62.0	55.1	49.4	72.4	5.1
0000	45	12/12/73	61.4	52.6	47.5	72.1	5.5
0100	45	12/12/73	62.7	54.9	48.3	73.5	5.6
0200	45	12/12/73	62.1	55.0	49.4	72.9	5.2
0300	45	12/12/73	64.1	55.7	50.2	74.6	5.5
0400	45	12/12/73	63.4	57.0	51.2	73.1	5.0
0500	45	12/12/73	62.8	56.0	51.2	72.0	4.8
0600	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
0700	0	12/12/73	NO DATA - EQUIPMENT PROBLEM				
0800	45	12/12/73	64.7	58.4	53.2	73.5	4.6
0900	45	12/12/73	65.5	60.3	54.5	74.4	4.5
1000	45	12/12/73	66.5	60.7	55.0	75.4	4.7
1100	45	12/12/73	66.6	60.3	53.8	76.5	5.2
1200	45	12/12/73	66.4	59.9	53.6	76.1	5.1
1300	45	12/12/73	65.7	59.3	52.6	75.2	5.1
1400	45	12/12/73	66.9	59.5	53.2	77.3	5.4
1500	45	12/12/73	65.2	57.0	48.1	79.4	6.7

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2W & 3E STATION 116+50 (ANNANDALE)

MICROPHONE POSITION 11

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
1400	45	01/29/74	61.7	53.6	47.2	72.8	5.8
1500	45	01/29/74	64.5	53.8	47.5	78.2	6.7
1600	45	01/29/74	62.5	54.7	47.9	73.0	5.6
1700	45	01/29/74	63.2	55.1	48.7	73.4	5.6
1800	0	01/29/74	NO DATA - EQUIPMENT PROBLEM				
1900	0	01/29/74	NO DATA - EQUIPMENT PROBLEM				
2000	45	01/29/74	69.7	61.5	54.3	82.1	6.2
2100	30	01/29/74	63.7	57.1	51.2	72.7	4.9
2200	0	01/29/74	NO DATA - MICROPHONE MALFUNCTION				
2300	0	01/29/74	NO DATA - MICROPHONE MALFUNCTION				
0000	30	01/30/74	61.0	53.8	48.1	70.3	5.1
0100	0	01/30/74	NO DATA - MICROPHONE MALFUNCTION				
0200	45	01/30/74	61.9	54.4	47.9	72.1	5.4
0300	0	01/30/74	NO DATA - MICROPHONE MALFUNCTION				
0400	0	01/30/74	NO DATA - MICROPHONE MALFUNCTION				
0500	45	01/30/74	64.3	57.0	50.3	74.2	5.4
0600	0	01/30/74	NO DATA - MICROPHONE MALFUNCTION				
0700	0	01/30/74	NO DATA - MICROPHONE MALFUNCTION				
0800	0	01/30/74	NO DATA - EQUIPMENT PROBLEM				
0900	0	01/30/74	NO DATA - EQUIPMENT PROBLEM				
1000	0	01/30/74	NO DATA - EQUIPMENT PROBLEM				
1100	45	01/30/74	64.6	59.3	53.1	73.5	4.7
1200	45	01/30/74	65.6	58.7	51.2	76.2	5.6
1300	45	01/30/74	63.8	57.5	51.6	72.8	4.8

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2M & 3E STATION 116+50 (ANNANDALE)

MICROPHONE POSITION 12

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
1200	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
1300	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
1400	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
1500	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
1600	45	02/28/74	60.7	55.7	50.8	68.4	4.1
1700	0	02/28/74	NO DATA - OPERATOR ERROR				
1800	0	02/28/74	NO DATA - OPERATOR ERROR				
1900	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
2000	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
2100	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
2200	45	02/28/74	56.3	51.6	46.7	63.2	3.9
2300	0	02/28/74	NO DATA - EQUIPMENT PROBLEM				
0000	45	03/01/74	58.1	52.8	47.7	65.6	4.2
0100	45	03/01/74	60.2	54.0	50.1	67.4	4.1
0200	45	03/01/74	59.3	53.5	47.2	67.9	4.7
0300	45	03/01/74	60.0	55.1	50.0	67.9	4.2
0400	45	03/01/74	59.9	56.1	51.7	66.1	3.4
0500	45	03/01/74	60.1	55.6	51.0	66.8	3.7
0600	45	03/01/74	60.0	54.4	50.1	68.6	4.3
0700	45	03/01/74	58.4	54.1	50.9	63.8	3.1
0800	45	03/01/74	60.1	56.3	52.1	66.8	3.4
0900	23	03/01/74	59.1	54.8	50.7	65.3	3.5
1000	45	03/01/74	58.4	53.9	50.1	64.4	3.4
1100	45	03/01/74	59.1	54.7	51.0	64.8	3.3

NOISE MEASUREMENT DATA

ROUTE I-78 SECTION 2W & 3E STATION 116+50 (ANNANDALE)

MICROPHONE POSITION 12

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
1200	45	03/01/74	57.5	53.3	50.0	63.3	3.3
1300	45	03/01/74	62.0	55.4	48.0	72.6	5.6
1400	45	03/01/74	57.4	52.6	48.2	64.3	3.8
1500	45	03/01/74	58.9	53.6	49.7	67.8	4.2
1600	45	03/01/74	59.5	55.2	51.2	65.3	3.3
1700	0	03/01/74	NO DATA - EQUIPMENT PROBLEM				

TRAFFIC DATA

Route I-78, Section 2M & 3E (Annandale)

		Westbound				Eastbound			
Hour	Date	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed Mph	Truck Speed* Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph
1700	12/04/73	603	115	-	-	393	121	-	-
1800	"	464	111	-	-	191	53	-	-
1900	"	246	120	-	-	80	40	-	-
2000	"	238	71	-	-	95	43	-	-
2100	"	-	-	-	-	-	-	-	-
2200	"	-	-	-	-	-	-	-	-
2300	"	109	92	-	-	60	84	-	-
0000	12/05/73	159	40	-	-	21	67	-	-
1400	12/06/73	223	188	-	-	237	153	-	-
1500	"	298	201	-	-	308	131	-	-
1600	"	345	200	-	-	332	117	-	-
1700	"	574	144	-	-	285	57	-	-
1800	"	414	161	-	-	204	71	-	-
1900	"	258	108	-	-	113	49	-	-
2000	"	224	85	-	-	99	63	-	-
2100	"	197	72	-	-	80	40	-	-
2200	"	227	33	-	-	83	75	-	-
2300	"	130	71	-	-	68	73	-	-
0000	12/07/73	142	57	-	-	24	84	-	-
0100	"	143	48	-	-	17	88	-	-
0200	"	112	28	-	-	12	84	-	-
0300	"	87	40	-	-	11	137	-	-

*No radar data taken

TRAFFIC DATA

Route I-78, Section 2M & 3E (Annandale)

		Westbound				Eastbound			
Hour	Date	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph
0400	12/07/73	140	48	-	-	13	120	-	-
0500	"	91	85	-	-	61	164	-	-
0600	"	39	127	-	-	151	160	-	-
0700	"	276	140	-	-	377	184	-	-
0800	"	347	100	-	-	384	191	-	-
0900	"	275	201	-	-	175	195	-	-
1000	"	243	223	-	-	227	169	-	-
1100	"	283	185	-	-	188	179	-	-
1200	"	-	-	-	-	-	-	-	-
1300	"	261	221	-	-	267	148	-	-
1600	12/11/73	352	193	-	-	332	118	-	-
1700	"	-	-	-	-	-	-	-	-
1800	"	440	135	-	-	257	72	-	-
1900	"	293	73	-	-	163	64	-	-
2000	"	209	100	-	-	108	53	-	-
2100	"	186	83	-	-	113	66	-	-
2200	"	170	90	-	-	85	76	-	-
2300	"	138	63	-	-	43	91	-	-
0000	12/12/73	140	59	-	-	31	85	-	-
0100	"	119	72	-	-	19	97	-	-
0200	"	60	71	-	-	11	104	-	-
0300	"	44	83	-	-	4	143	-	-
0400	"	101	87	-	-	23	163	-	-

*No radar data taken

TRAFFIC DATA

Route I-78, Section 2M & 3E (Annandale)

		Westbound				Eastbound			
Hour	Date	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph
0500	12/12/73	85	91	-	-	73	206	-	-
0600	"	52	114	-	-	253	204	-	-
0700	"	297	119	-	-	741	248	-	-
0800	"	303	144	-	-	524	180	-	-
0900	"	299	177	-	-	307	170	-	-
1000	"	-	-	-	-	-	-	-	-
1100	"	168	220	-	-	204	180	-	-
1200	"	-	-	-	-	-	-	-	-
1300	"	204	202	-	-	254	168	-	-
1400	"	141	202	-	-	219	117	-	-
1500	"	214	222	-	-	242	89	-	-

*No radar data taken

TRAFFIC DATA

Route I-78, Section 2M & 3E (Annandale)

		Westbound				Eastbound			
Hour	Date	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph
1400	01/29/74	164	205	-	-	197	99	-	-
1500	"	219	129	-	-	263	116	-	-
1600	"	323	147	-	-	320	68	-	-
1700	"	489	161	-	-	476	65	-	-
1800	"	343	104	-	-	264	94	-	-
1900	"	208	164	-	-	140	48	-	-
2000	"	87	61	-	-	104	55	-	-
2100	"	98	140	-	-	130	50	-	-
2200	"	97	40	-	-	84	76	-	-
2300	"	84	112	-	-	59	101	-	-
0000	01/30/74	60	37	-	-	27	93	-	-
0100	"	68	83	-	-	48	67	-	-
0200	"	37	112	-	-	25	109	-	-
0300	"	0	40	-	-	0	136	-	-
0400	"	8	84	-	-	8	152	-	-
0500	"	0	88	-	-	24	92	-	-
0600	"	29	79	-	-	219	145	-	-
0700	"	132	92	-	-	393	126	-	-
0800	"	149	105	-	-	499	178	-	-
0900	"	204	184	-	-	240	198	-	-
1000	"	192	144	-	-	192	144	-	-
1100	"	139	208	-	-	149	189	-	-
1200	"	156	312	-	-	232	164	-	-

*No radar data taken

TRAFFIC DATA

Route I-78, Section 2M & 3E (Annandale)

		Westbound				Eastbound			
Hour	Date	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed Mph	Truck Speed Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph
1200	02/28/74	250	108	57	48	249	107	-	-
1300	"	245	105	51	44	245	105	-	-
1400	"	276	118	50	44	283	120	-	-
1500	"	309	132	50	44	280	120	-	-
1600	"	454	195	51	47	325	140	-	-
1700	"	534	229	49	47	271	118	-	-
1800	"	347	149	49	45	236	72	-	-
1900	"	208	90	50	45	146	104	-	-
2000	"	152	66	49	46	68	119	-	-
2100	"	144	62	39	42	130	56	-	-
2200	"	136	59	45	40	121	51	-	-
2300	"	119	51	46	38	136	14	-	-
0000	03/01/74	92	60	48	38	17	119	-	-
0100	"	38	82	50	37	31	107	-	-
0200	"	56	72	38	38	99	42	-	-
0300	"	54	55	45	36	14	159	-	-
0400	"	63	68	45	36	30	186	-	-
0500	"	54	72	44	36	210	90	-	-
0600	"	117	70	49	42	371	159	-	-
0700	"	192	109	51	54	628	269	-	-
0800	"	236	120	50	50	431	185	-	-
0900	"	290	125	55	47	223	150	-	-

*No Radar Data Taken

TRAFFIC DATA

Route I-78, Section 2M & 3E (Annandale)

		Westbound				Eastbound			
Hour	Date	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed Mph	Truck Speed Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph
1000	03/01/74	215	179	55	48	249	103	-	-
1100	"	197	229	55	47	198	149	-	-
1200	"	238	188	57	48	233	99	-	-
1300	"	287	148	51	44	266	116	-	-
1400	"	286	187	50	44	271	116	-	-
1500	"	323	172	50	44	340	146	-	-
1600	"	533	228	51	47	339	120	-	-
1700	"	612	263	49	47	406	65	-	-

*No radar data taken

WEATHER DATA

Route I-78, Section 2M and 3E (Annandale)

Hour	Date	Wind Speed Mph	Wind Direction Degree	Temperature °F
1700	12/04/73	0-3	162	54
1800	12/04/73	0-3	180	53
1900	12/04/73	0-3	208	53
2000	12/04/73	0-3	172	53
2100	12/04/73	0-3	158	53
2200	12/04/73	0-3	126	53
2300	12/04/73	0-3	126	53
0000	12/05/73	0-3	120	50
1400	12/06/73	15	298	48
1500	12/06/73	5	2	48
1600	12/06/73	5	342	45
1700	12/06/73	5	351	42
1800	12/06/73	0-3	342	41
1900	12/06/73	0-3	336	40.5
2000	12/06/73	0-3	330	38
2100	12/06/73	0-3	303	38
2200	12/06/73	0-3	312	37
2300	12/06/73	0-3	315	36
0000	12/07/73	0-3	330	35
0100	12/07/73	0-3	346	35
0200	12/07/73	0-3	330	30
0300	12/07/73	0-3	330	32

WEATHER DATA

Route I-78, Section 2M and 3E (Annandale)

Hour	Date	Wind Speed Mph	Wind Direction Degree	Temperature °F
0400	12/07/73	0-3	330	31
0500	12/07/73	0-3	330	32
0600	12/07/73	0-3	330	31
0700	12/07/73	0-3	330	34
0800	12/07/73	0-3	340	34
0900	12/07/73	0-3	350	35
1000	12/07/73	5	30	41
1100	12/07/73	0-3	20	42
1200	12/07/73	0-3	28	42
1300	12/07/73	0-3	12	43
1600	12/11/73	3	347	36.5
1700	12/11/73	8	345	34
1800	12/11/73	9	331	31
1900	12/11/73	5	335	30
2000	12/11/73	5	340	30
2100	12/11/73	5	340	30
2200	12/11/73	0-3	330	30
2300	12/11/73	0-3	345	30
0000	12/12/73	0-3	340	29
0100	12/12/73	0-3	335	28
0200	12/12/73	9-3	335	28

WEATHER DATA

Route I-78, Section 2M and 3E (Annandale)

Hour	Date	Wind Speed Mph	Wind Direction Degree	Temperature °F
0300	12/12/73	0-3	330	28
0400	12/12/73	0-3	326	29
0500	12/12/73	0-3	330	30
0600	12/12/73	0-3	330	29
0700	12/12/73	0-3	330	28
0800	12/12/73	0-3	330	28
0900	12/12/73	0-3	308	33
1000	12/12/73	7	308	36
1100	12/12/73	6	318	33
1200	12/12/73	0-3	330	35.5
1300	12/12/73	5	308	36
1400	12/12/73	0-3	308	35.5
1500	12/12/73	3	314	36
1600	02/28/74	---	---	51
1700	02/28/74	---	---	51
1800	02/28/74	---	---	49
1900	02/28/74	---	---	49
2000	02/28/74	---	---	46
2100	02/28/74	---	---	45
2200	02/28/74	---	---	42
2300	02/28/74	---	---	--

WEATHER DATA

Route I-78, Section 2M and 3E (Annandale)

Hour	Date	Wind Speed Mph	Wind Direction Degree	Temperature ^{o}F
0000	03/01/74	---	---	41
0100	03/01/74	---	---	39
0200	03/01/74	---	---	41
0300	03/01/74	---	---	40
0400	03/01/74	---	---	40
0500	03/01/74	---	---	39
0600	03/01/74	---	---	38
0700	03/01/74	---	---	35
0800	03/01/74	---	---	36
0900	03/01/74	---	---	38
1000	03/01/74	---	---	41
1100	03/01/74	---	---	40
1200	03/01/74	---	---	39
1300	03/01/74	---	---	45
1400	03/01/74	10	---	47
1500	03/01/74	---	---	48
1600	03/01/74	10	---	47.5

ROUTE I-287, SECTION 1E, 4B AND 5B

(BRIDGEWATER)

SITE DESCRIPTION

Location

Route and Section: Route I-287, Section 1E, 4B and 5B

Station or Street: Station 847+50

Municipality: Bridgewater County: Somerset

Facility: Bridgewater-Raritan High School East

Sound Propagation Path Characteristics

Roadway: At-Grade

Barriers: Earth Berms along Roadway Edge and in Median

Terrain: Flat, Grassy, Deciduous Trees (15' to 20' high) and Brush to the East of Microphone Locations

Road Description

Pavement Type: Bituminous Concrete

Pavement Quality: Normal

Number of Lanes: Near Lanes 2 Far Lanes 2

Lane Width: 12 feet

Grade: Near Lanes 0.8% Far Lanes 1%

Center Barrier: None

Median: Grassy Mound, 150 feet wide

SITE DESCRIPTION

Microphone Location

	Position 1	Position 2	Position 3
Height of Microphone Above Ground	5'	5'	5'
Height of Microphone with Respect to Near Lane	2'	6'	13'
Distance to Near Lane	100'	200'	400'

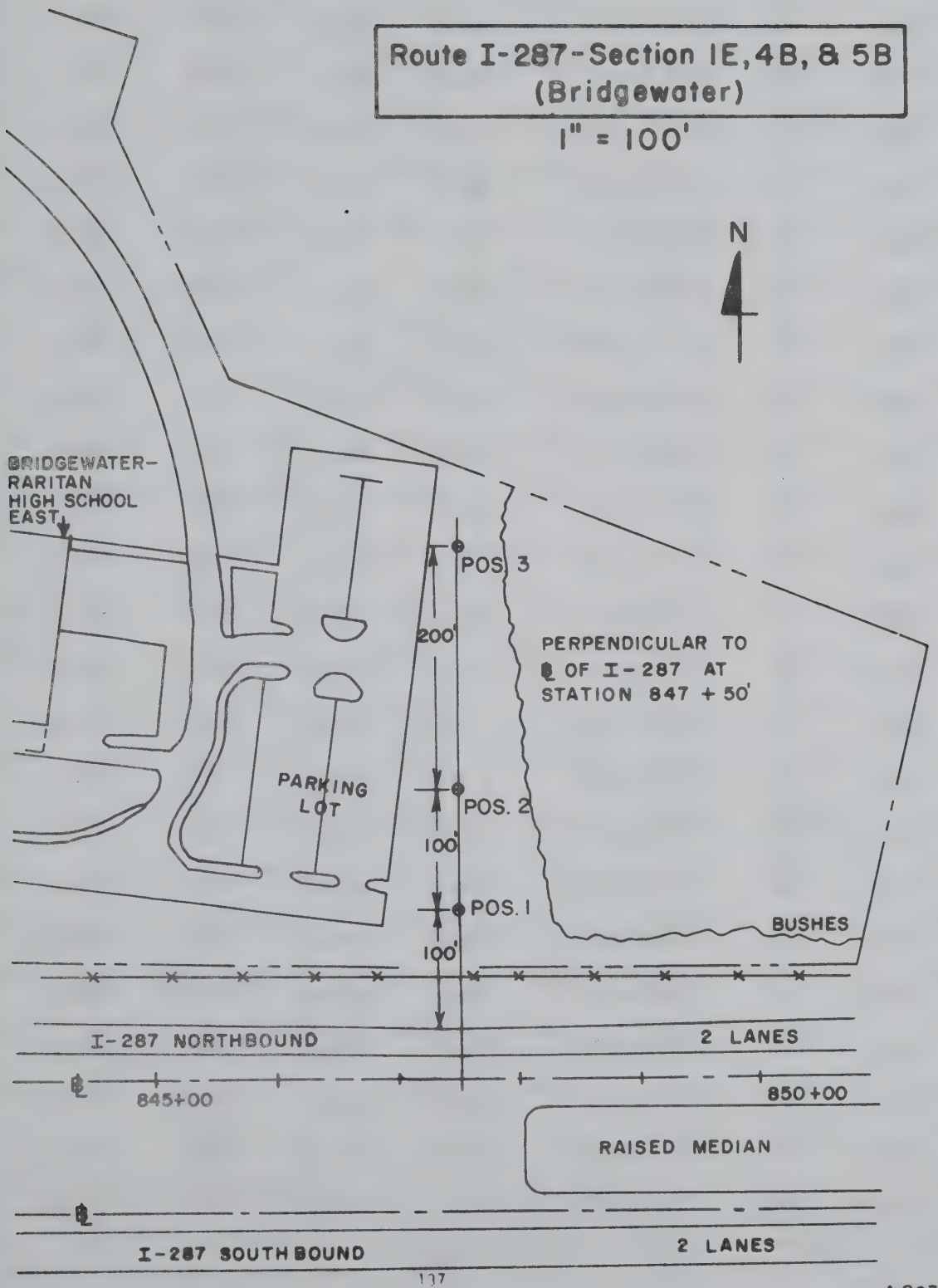
Traffic Data Collection

Traffic Counter Locations: I-287, Northbound and Southbound

Radar Location: I-287, Northbound

Noise Contributions from Other Sources

Adjacent Parking Lot


Route I-287-Section 1E, 4B, & 5B
(Bridgewater)
1" = 100'
N
BRIDGEWATER-
RARITAN
HIGH SCHOOL
EAST
POS. 3
200'
PERPENDICULAR TO
℄ OF I-287 AT
STATION 847 + 50'
PARKING
LOT
POS. 2
100'
POS. 1
100'
BUSHES
I-287 NORTHBOUND
2 LANES
℄
845+00
850+00
RAISED MEDIAN
℄
I-287 SOUTHBOUND
2 LANES

A-883

NOISE MEASUREMENT DATA

ROUTE I-287 SECTION 1E, 4B & 5B (BRIDGEWATER)

MICROPHONE POSITION 1

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
****	****	****	*****	*****	*****	*****	*****
1200	45	03/14/74	77.0	67.2	58.9	90.0	6.7
1300	45	03/14/74	76.9	66.8	58.9	89.8	6.7
1400	45	03/14/74	77.6	67.2	59.4	90.5	6.8
1500	45	03/14/74	76.6	67.1	60.3	88.5	6.2
1600	45	03/14/74	76.9	68.2	61.8	87.9	5.8
1700	45	03/14/74	76.1	68.2	62.3	86.8	5.5
1800	45	03/14/74	75.3	66.6	60.0	86.6	5.9
1900	45	03/14/74	74.6	64.4	56.2	89.0	7.0
2000	45	03/14/74	74.3	62.9	53.1	92.0	8.1
2100	45	03/14/74	72.4	62.9	54.6	88.3	7.2
2200	45	03/14/74	70.6	60.5	52.7	87.5	7.4
2300	45	03/14/74	73.0	61.9	53.3	90.3	7.7
0000	45	03/15/74	75.1	63.3	53.5	92.1	8.1
0100	45	03/15/74	71.1	58.3	48.7	90.9	8.7
0200	45	03/15/74	70.9	57.5	48.0	90.4	8.8
0300	45	03/15/74	74.6	61.1	48.7	95.2	9.6
0400	45	03/15/74	75.3	63.9	52.6	93.5	8.6
0500	45	03/15/74	76.2	67.2	57.2	91.2	7.3
0600	45	03/15/74	76.8	66.8	58.0	91.3	7.1
0700	45	03/15/74	76.2	69.6	64.0	85.8	5.0
0800	45	03/15/74	74.7	67.3	60.5	85.6	5.6
0900	45	03/15/74	76.2	67.5	60.0	87.7	6.2
1000	45	03/15/74	77.0	67.9	59.1	89.8	6.7
1100	45	03/15/74	77.1	67.6	57.4	92.0	7.4

NOISE MEASUREMENT DATA

ROUTE I-287 SECTION 1E, 4B & 5B (BRIDGEWATER)

MICROPHONE POSITION 2

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
****	****	****	*****	*****	*****	*****	*****
1200	45	03/14/74	66.5	60.5	54.2	75.6	4.8
1300	45	03/14/74	67.5	61.2	55.1	77.0	4.9
1400	45	03/14/74	67.8	61.3	55.4	77.2	5.0
1500	45	03/14/74	68.1	61.9	56.6	76.7	4.6
1600	45	03/14/74	69.1	63.2	57.8	77.3	4.4
1700	45	03/14/74	68.3	62.4	57.2	76.4	4.4
1800	45	03/14/74	67.7	60.5	55.8	76.3	4.7
1900	45	03/14/74	67.4	59.1	53.2	77.7	5.5
2000	45	03/14/74	66.3	56.7	50.1	78.8	6.3
2100	45	03/14/74	65.9	57.5	51.5	76.9	5.7
2200	45	03/14/74	63.6	54.6	47.5	76.0	6.2
2300	45	03/14/74	65.8	56.7	49.2	79.2	6.6
0000	45	03/15/74	68.6	59.5	50.3	82.1	6.9
0100	45	03/15/74	65.7	55.2	46.7	80.9	7.4
0200	45	03/15/74	64.2	53.0	44.4	79.7	7.7
0300	45	03/15/74	67.6	58.3	46.3	84.8	8.2
0400	45	03/15/74	69.3	61.1	50.8	83.2	7.0
0500	45	03/15/74	70.3	64.1	54.8	82.3	6.0
0600	45	03/15/74	69.4	62.0	54.9	80.2	5.6
0700	45	03/15/74	69.5	64.4	60.2	76.1	3.8
0800	45	03/15/74	66.5	60.6	55.4	74.7	4.5
0900	45	03/15/74	67.4	61.3	55.3	76.6	4.9
1000	45	03/15/74	68.3	61.5	54.1	79.0	5.5
1100	45	03/15/74	68.7	61.0	52.5	81.5	6.4

NOISE MEASUREMENT DATA

ROUTE I-287 SECTION 1E, 4B & 5B (BRIDGEWATER)

MICROPHONE POSITION 3

HOUR ****	SAMPLE SIZE (MIN.) ****	DATE ****	L10 (DBA) *****	L50 (DBA) *****	L90 (DBA) *****	LNP (DBA) *****	STD DEV (DBA) *****
1200	45	03/14/74	52.6	48.1	44.3	58.9	3.5
1300	45	03/14/74	51.5	46.8	42.3	58.4	3.8
1400	45	03/14/74	52.8	47.8	43.3	59.6	3.8
1500	45	03/14/74	53.4	48.8	45.2	59.4	3.4
1600	45	03/14/74	54.3	49.2	45.3	60.9	3.7
1700	45	03/14/74	53.8	48.7	44.9	60.6	3.8
1800	45	03/14/74	53.3	47.6	42.7	61.0	4.2
1900	45	03/14/74	53.3	46.2	41.1	62.1	4.8
2000	45	03/14/74	51.8	43.5	38.2	61.7	5.3
2100	45	03/14/74	51.6	43.6	38.2	67.2	5.6
2200	45	03/14/74	52.7	44.3	38.6	62.6	5.4
2300	45	03/14/74	53.3	45.0	38.6	63.8	5.6
0000	45	03/15/74	53.7	46.3	38.7	64.3	5.7
0100	45	03/15/74	51.1	41.2	36.9	61.4	5.6
0200	45	03/15/74	49.7	40.2	36.8	59.2	5.2
0300	45	03/15/74	53.6	45.8	37.7	65.4	6.1
0400	45	03/15/74	55.3	49.0	39.7	66.7	5.9
0500	45	03/15/74	57.3	51.7	43.1	67.9	5.5
0600	45	03/15/74	54.9	48.9	42.9	63.9	4.8
0700	45	03/15/74	55.2	51.0	46.7	61.1	3.4
0800	45	03/15/74	49.5	45.1	40.7	55.8	3.6
0900	45	03/15/74	49.8	45.5	40.3	56.9	3.9
1000	45	03/15/74	50.0	45.0	38.9	58.2	4.4
1100	45	03/15/74	51.3	45.4	38.3	61.3	5.1

TRAFFIC DATA

Route I-287, Section 1E, 4B & 5B (Bridgewater)

		Northbound				Southbound			
Hour	Date	Auto Volume Veh/Hr.	Truck Volume Veh/Hr	Auto Speed Mph	Truck Speed Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph
1200	03/14/74	246	217	54	53	296	204	-	-
1300	"	248	186	52	52	74	184	-	-
1400	"	269	221	53	53	130	160	-	-
1500	"	504	183	54	55	386	162	-	-
1600	"	727	204	53	54	552	141	-	-
1700	"	938	159	54	55	500	112	-	-
1800	"	657	96	54	55	377	89	-	-
1900	"	420	119	54	54	256	75	-	-
2000	"	245	96	55	55	172	73	-	-
2100	"	232	59	54	53	148	60	-	-
2200	"	214	49	53	54	122	71	-	-
2300	"	119	49	54	56	81	100	-	-
0000	03/15/74	97	77	55	57	64	87	-	-
0100	"	42	46	54	56	25	96	-	-
0200	"	30	61	56	56	12	88	-	-
0300	"	24	95	59	58	19	120	-	-
0400	"	18	83	54	57	34	167	-	-
0500	"	34	109	56	56	36	207	-	-
0600	"	152	101	55	57	251	204	-	-
0700	"	190	47	56	57	817	229	-	-
0800	"	496	140	54	54	984	325	-	-
0900	"	471	203	55	54	429	228	-	-
1000	"	409	275	55	55	324	224	-	-
1100	"	327	212	55	55	304	177	-	-

*No radar data taken

WEATHER DATA

Route I-287, Section 1E, 4B and 5B (Bridgewater)

Hour	Date	Wind Speed Mph	Wind Direction Degree	Temperature °F
1200	03/14/74	20	260	45
1300	03/14/74	20	260	46.5
1400	03/14/74	20	260	47.5
1500	03/14/74	20	280	47.5
1600	03/14/74	20	295	50
1700	03/14/74	20	300	49.5
1800	03/14/74	20	275	46.5
1900	03/14/74	20	285	44
2000	03/14/74	0-3	315	41
2100	03/14/74	0-3	295	38
2200	03/14/74	0-3	290	37
2300	03/14/74	0-3	288	36
0000	03/15/74	0-3	295	33
0100	03/15/74	0-3	300	30
0200	03/15/74	0-3	285	29
0300	03/15/74	0-3	285	28.5
0400	03/15/74	0-3	290	28.5
0500	03/15/74	0-3	275	26
0600	03/15/74	0-3	320	24
0700	03/15/74	0-3	305	22

WEATHER DATA

Route I-287, Section 1E, 4B and 5B (Bridgewater)

Hour	Date	Wind Speed Mph	Wind Direction Degree	Temperature °F
0800	03/15/74	0-3	305	28
0900	03/15/74	0-3	270	32
1000	03/15/74	0-3	278	39
1100	03/15/74	0-3	280	46

ROUTE I-80, SECTION 1B AND 2L

(NETCONG)

SITE DESCRIPTION

Location

Route and Section: Route I-80, Section 1B and 2L

Station or Street: Station 475 (I-80)

Municipality: Roxbury Township County: Morris

Facility: New Jersey Department of Transportation Maintenance Yard, Netcong

Sound Propagation Path Characteristics

Roadway: Elevated (I-80)

Barriers: Earth Ridges

Terrain: Woods and Brush

Road Description

Pavement Type: Bituminous Concrete

Pavement Quality: Normal

Number of Lanes: Near Lanes 3 Far Lanes 3

Lane Width: 12 feet

Grade: Near Lanes 1.2% Far Lanes 1.3%

Center Barrier: None

Median: Grass, 42 feet wide

SITE DESCRIPTION

Microphone Location

	Pos. 1	Pos. 2	Pos. 3	Pos. 4
Height of Microphone Above Ground	5'	5'	5'	5'
Height of Microphone with Respect to Near Lane	5'	3'	-4'	-24'
Distance to Near Lane	202'	377'	232'	772'

Traffic Data Collection

Traffic Counter Locations: I-80, Westbound Ramp, I-80,Westbound to Route 206, Northbound

Radar Location: I-80, Eastbound and Westbound

Noise Contributions from Other Sources

None

SITE DESCRIPTION

Location

Route and Section: Route I-80, Section 1B and 2C

Station or Street: Station 30 (Route 206)

Municipality: Roxbury Township County: Morris

Facility: New Jersey Department of Transportation Maintenance Yard, Netcong

Sound Propagation Path Characteristics

Roadway: At-Grade (Route 206)

Barriers: Earth Ridges

Terrain: Woods and Brush

Road Description

Pavement Type: Bituminous Concrete

Pavement Quality: Normal

Number of Lanes: Near Lanes 2 Far Lanes 2

Lane Width: 12 feet

Grade: Near Lanes 4% to 1% Far Lanes 4% to 1%

Center Barrier: None

Median: Concrete, 5 feet wide to Grass, 5 feet to 300 feet wide

SITE DESCRIPTION

Microphone Location

	Position 5	Position 6	Position 8
Height of Microphone Above Ground	5'	5'	5'
Height of Microphone with Respect to Near Lane	22'	6'	14'
Distance to Near Lane	249'	164'	504'

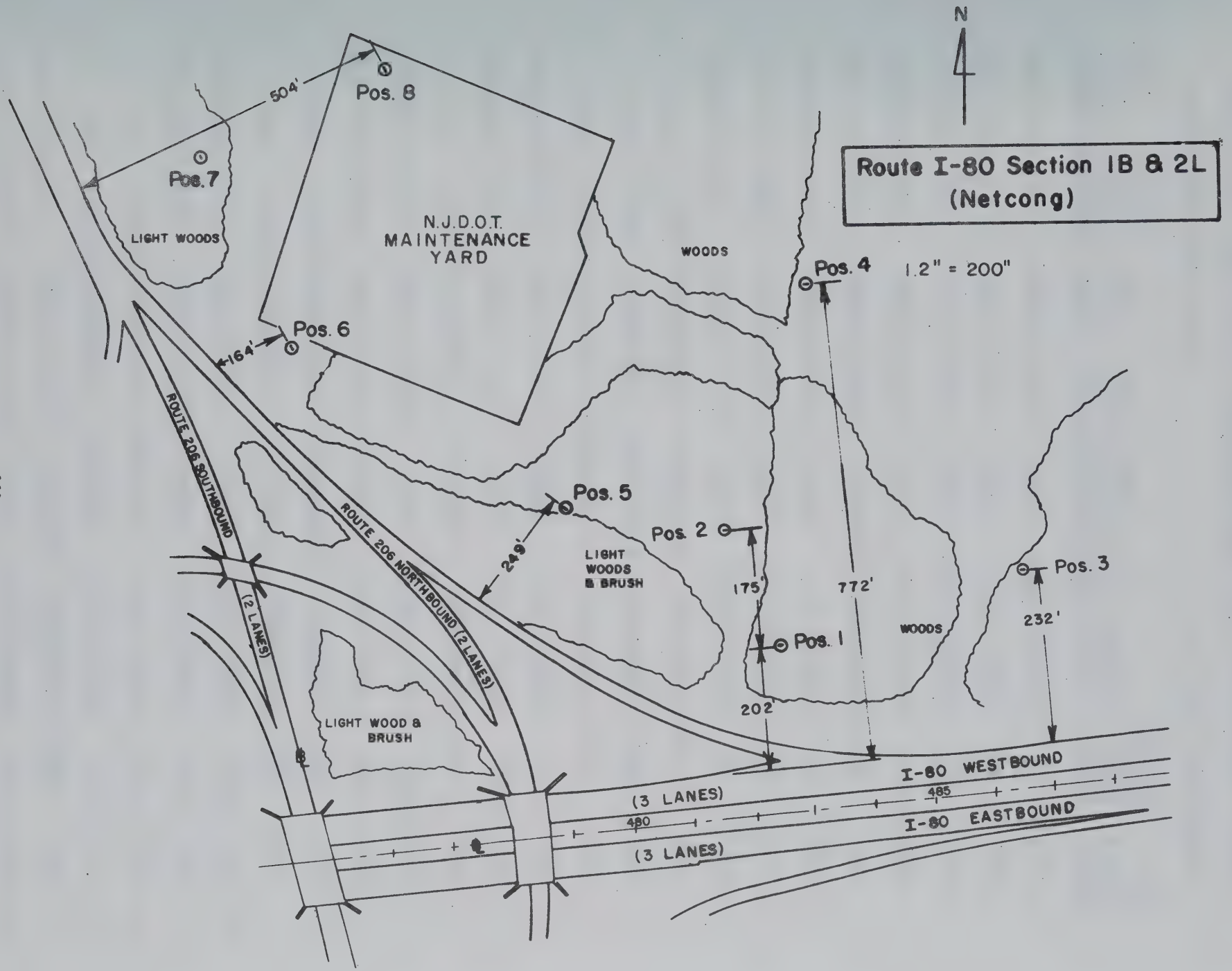
Traffic Data Collection

Traffic Counter Location: Route 206, Northbound and Southbound

Radar Location: Route 206, Northbound and Southbound

Noise Contributions from Other Sources

Maintenance Yard


N
Route I-80 Section 1B & 2L
(Netcong)
1.2" = 200"
Pos. 8
504'
Pos. 7
LIGHT WOODS
N.J.D.O.T.
MAINTENANCE
YARD
WOODS
Pos. 4
Pos. 6
164'
ROUTE 206 SOUTHBOUND
(2 LANES)
ROUTE 206 NORTHBOUND (2 LANES)
Pos. 5
Pos. 2
249'
LIGHT
WOODS
& BRUSH
175'
772'
Pos. 3
232'
Pos. 1
WOODS
202'
LIGHT WOOD &
BRUSH
I-80 WESTBOUND
(3 LANES)
485
480
I-80 EASTBOUND
(3 LANES)

NOISE MEASUREMENT DATA

ROUTE I-80 SECTION 1B & 2L (NETCONG)

MICROPHONE POSITION 1

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
1700	30	04/02/74	66.4	62.3	58.2	73.0	3.5
1800	30	04/02/74	66.9	62.1	57.5	73.4	3.7
1900	30	04/02/74	66.8	61.9	57.2	74.8	4.1
2000	30	04/02/74	65.7	59.1	53.0	75.2	5.1
2100	30	04/02/74	69.4	62.6	56.4	79.1	5.1
2200	30	04/02/74	64.8	57.4	51.1	74.7	5.3
2300	30	04/02/74	70.6	64.2	57.9	80.0	5.1
0000	30	04/03/74	69.3	62.7	56.5	78.8	5.1
0100	0	04/03/74	NO DATA - OPERATOR ERROR				
0200	0	04/03/74	NO DATA - OPERATOR ERROR				
0300	0	04/03/74	NO DATA - OPERATOR ERROR				
0400	30	04/03/74	65.4	60.9	54.4	74.1	4.6
0500	29	04/03/74	67.6	61.9	55.7	77.4	5.2
0600	0	04/03/74	NO DATA - OPERATOR ERROR				
0700	30	04/03/74	64.8	60.2	56.1	71.1	3.6
0800	30	04/03/74	67.0	62.8	59.0	74.0	3.6
0900	0	04/03/74	NO DATA - OPERATOR ERROR				
1000	0	04/03/74	NO DATA - OPERATOR ERROR				
1100	30	04/03/74	70.6	65.8	60.9	77.9	4.0
1200	30	04/03/74	72.5	66.4	60.4	82.6	5.3
1300	0	04/03/74	NO DATA - OPERATOR ERROR				
1400	0	04/03/74	NO DATA - OPERATOR ERROR				
1500	30	04/03/74	71.5	66.3	61.3	79.4	4.2
1600	30	04/03/74	71.1	66.7	62.2	78.6	3.9

NOISE MEASUREMENT DATA

ROUTE I-80 SECTION 1B & 2L (NETCONG)

MICROPHONE POSITION 2

HOUR ****	SAMPLE SIZE (MIN.) ****	DATE ****	L10 (DBA) *****	L50 (DBA) *****	L90 (DBA) *****	LNP (DBA) *****	STD DEV (DBA) *****
1700	30	04/02/74	59.9	56.2	52.1	65.4	3.1
1800	30	04/02/74	58.6	54.3	50.9	63.6	3.1
1900	30	04/02/74	60.5	56.5	52.3	67.1	3.5
2000	30	04/02/74	60.4	56.4	52.0	66.8	3.5
2100	0	04/02/74	NO DATA - OPERATOR ERROR				
2200	30	04/02/74	59.1	54.7	50.9	64.7	3.3
2300	30	04/02/74	61.9	57.0	52.3	68.2	3.7
0000	30	04/03/74	61.6	57.0	52.3	68.0	3.7
0100	0	04/03/74	NO DATA - OPERATOR ERROR				
0200	0	04/03/74	NO DATA - OPERATOR ERROR				
0300	0	04/03/74	NO DATA - OPERATOR ERROR				
0400	30	04/03/74	62.9	58.7	54.6	69.4	3.7
0500	29	04/03/74	64.2	59.9	55.5	70.5	3.6
0600	0	04/03/74	NO DATA - OPERATOR ERROR				
0700	30	04/03/74	61.8	58.1	55.1	66.9	2.9
0800	30	04/03/74	60.5	57.2	53.7	66.8	3.2
0900	0	04/03/74	NO DATA - OPERATOR ERROR				
1000	0	04/03/74	NO DATA - OPERATOR ERROR				
1100	30	04/03/74	62.8	58.3	54.3	68.7	3.5
1200	30	04/03/74	64.3	59.5	54.4	72.1	4.2
1300	30	04/03/74	68.7	64.1	58.9	75.5	3.9
1400	30	04/03/74	67.5	63.1	59.2	73.7	3.5
1500	0	04/03/74	NO DATA - OPERATOR ERROR				
1600	30	04/03/74	67.9	63.6	60.4	73.6	3.2

NOISE MEASUREMENT DATA

ROUTE I-80 SECTION 1B & 2L (NETCONG)

MICROPHONE POSITION 4

HOUR ****	SAMPLE SIZE (MIN.) ****	DATE ****	L10 (DBA) *****	L50 (DBA) *****	L90 (DBA) *****	LNP (DBA) *****	STD DEV (DBA) *****
1800	30	04/02/74	58.6	54.5	51.2	64.5	3.1
1900	30	04/02/74	56.3	53.1	50.4	60.7	2.6
2000	30	04/02/74	56.8	52.7	48.9	62.5	3.3
2100	30	04/02/74	59.4	55.3	51.5	64.7	3.1
2200	30	04/02/74	57.4	53.5	50.5	62.2	2.9
2300	30	04/02/74	57.9	53.6	50.2	63.3	3.2
0000	30	04/03/74	57.7	53.6	50.4	62.7	3.0
0100	30	04/03/74	59.2	54.6	50.1	65.8	3.7
0200	30	04/03/74	60.9	56.0	48.8	70.4	4.9
0300	30	04/03/74	59.6	55.4	51.1	66.0	3.6
0400	30	04/03/74	60.9	57.7	54.8	65.9	2.8
0500	30	04/03/74	62.2	58.3	55.1	67.3	3.0
0600	30	04/03/74	61.0	58.0	55.4	65.3	2.5
0700	30	04/03/74	61.4	58.2	55.7	65.6	2.5
0800	30	04/03/74	59.5	56.6	52.8	65.4	3.1
0900	30	04/03/74	59.3	56.5	52.8	63.8	2.7
1000	30	04/03/74	60.1	57.1	53.7	65.4	2.9
1100	0	04/03/74	NO DATA - MICROPHONE MALFUNCTION				
1200	30	04/03/74	62.2	57.8	54.1	69.2	3.7
1300	30	04/03/74	62.4	57.9	53.8	68.8	3.6
1400	30	04/03/74	63.4	59.1	55.6	68.7	3.2
1500	30	04/03/74	62.0	58.0	54.7	67.9	3.2
1600	30	04/03/74	63.0	58.8	55.8	68.7	3.1

NOISE MEASUREMENT DATA

ROUTE I-80 SECTION 1B & 2L (NETCONG)

MICROPHONE POSITION 5

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
1500	30	04/04/74	59.1	54.7	50.6	65.6	3.6
1600	30	04/04/74	58.5	54.6	50.9	63.3	3.0
1700	0	04/04/74	NO DATA - OPERATOR ERROR				
1800	0	04/04/74	NO DATA - OPERATOR ERROR				
1900	30	04/04/74	54.0	49.7	46.3	59.4	3.1
2000	30	04/04/74	58.8	49.5	45.8	68.0	5.2
2100	30	04/04/74	53.1	48.9	45.6	58.3	3.1
2200	30	04/04/74	55.9	52.4	48.8	61.9	3.2
2300	30	04/04/74	55.5	50.9	46.7	61.4	3.5
0000	30	04/05/74	57.2	52.6	48.0	63.7	3.7
0100	30	04/05/74	58.6	52.2	46.1	67.7	4.9
0200	30	04/05/74	52.3	47.4	41.4	60.2	4.4
0300	30	04/05/74	50.8	45.4	39.5	59.4	4.6
0400	30	04/05/74	53.7	47.9	41.6	62.8	4.8
0500	30	04/05/74	52.9	48.1	43.3	60.2	4.1
0600	30	04/05/74	53.6	49.3	45.5	59.0	3.3
0700	30	04/05/74	54.6	51.3	47.3	59.8	3.0
0800	0	04/05/74	NO DATA - EQUIPMENT PROBLEM				
0900	0	04/05/74	NO DATA - NONREPRESENTATIVE NOISE				
1000	30	04/05/74	53.7	48.4	43.0	61.9	4.4

NOISE MEASUREMENT DATA

ROUTE I-80 SECTION 1B & 2L (NETCONG)

MICROPHONE POSITION 8

HOUR	SAMPLE SIZE (MIN.)	DATE	L10 (DBA)	L50 (DBA)	L90 (DBA)	LNP (DBA)	STD DEV (DBA)
1500	30	04/04/74	54.9	51.6	47.6	60.8	3.1
1600	30	04/04/74	54.9	52.4	49.9	58.9	2.3
1700	30	04/04/74	54.8	52.6	50.3	58.0	1.9
1800	0	04/04/74	NO DATA - NONREPRESENTATIVE NOISE				
1900	30	04/04/74	54.9	50.9	46.8	60.7	3.3
2000	30	04/04/74	53.3	49.2	45.9	58.1	2.9
2100	30	04/04/74	52.8	48.8	45.8	57.4	2.8
2200	30	04/04/74	53.9	50.1	46.4	58.6	2.9
2300	30	04/04/74	54.4	50.7	46.6	59.9	3.2
0000	30	04/05/74	53.0	48.7	45.2	58.3	3.2
0100	30	04/05/74	54.4	49.3	44.6	61.7	4.0
0200	30	04/05/74	54.2	49.9	45.2	60.8	3.7
0300	30	04/05/74	54.5	50.0	45.3	61.4	3.8
0400	30	04/05/74	55.2	50.7	45.7	62.7	4.0
0500	30	04/05/74	55.3	51.7	47.5	61.4	3.3
0600	30	04/05/74	55.5	52.4	49.3	60.7	2.9
0700	30	04/05/74	56.9	53.4	50.8	61.7	2.6
0800	30	04/05/74	56.9	53.5	50.9	61.0	2.5
0900	30	04/05/74	55.3	52.6	49.9	59.8	2.5

TRAFFIC DATA

Route I-80, Section 1B & 2L (Netcong)

Hour	Date	I-80 Westbound				I-80 Eastbound				Ramp			
		Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed Mph	Truck Speed Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph
1700	04/02/74	2301	140	53	47	764	86	-	-	238	4	-	-
1800	"	1320	118	53	48	788	84	-	-	132	4	-	-
1900	"	852	62	54	49	508	56	-	-	79	8	-	-
2000	"	510	94	56	47	337	62	-	-	65	0	-	-
2100	"	508	92	49	45	327	66	-	-	49	0	-	-
2200	"	554	84	51	45	361	52	-	-	54	0	-	-
2300	"	348	138	51	45	342	78	-	-	30	0	-	-
0000	04/03/74	282	64	50	46	108	146	-	-	21	2	-	-
0100	"	148	68	47	43	57	116	-	-	9	0	-	-
0200	"	86	98	50	42	72	126	-	-	7	0	-	-
0300	"	62	66	48	45	59	124	-	-	6	0	-	-
0400	"	58	66	43	45	71	166	-	-	2	0	-	-
0500	"	66	84	49	46	363	118	-	-	13	0	-	-
0600	"	158	72	49	45	1280	166	-	-	23	0	-	-

*No radar data taken

TRAFFIC DATA

Route I-80, Section 1B & 2L (Netcong)

Hour	Date	I-80 Westbound				I-80 Eastbound				Ramp			
		Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed Mph	Truck Speed Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph
0700	04/03/74	574	108	53	46	3030	228	-	-	80	0	-	-
0800	"	732	156	50	45	2019	186	-	-	92	2	-	-
0900	"	614	196	49	42	638	130	-	-	57	8	-	-
1000	"	630	250	49	41	480	176	-	-	63	10	-	-
1100	"	443	216	50	41	440	160	-	-	56	4	-	-
1200	"	475	184	52	43	450	128	-	-	54	4	-	-
1300	"	468	220	50	42	470	118	-	-	55	2	-	-
1400	"	490	194	47	42	508	142	-	-	55	6	-	-
1500	"	578	144	51	41	708	78	-	-	97	14	-	-
1600	"	1071	140	51	41	984	109	-	-	243	8	-	-

*No radar data taken

TRAFFIC DATA

Route I-80, Section 1B & 2L (Netcong)

Hour	Date	Rt. 206 Northbound				Rt. 206 Southbound				Ramp			
		Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed Mph	Truck Speed Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed Mph	Truck Speed Mph
1500	04/04/74	317	50	42	36	256	38	-	-				
1600	"	502	14	35	31	278	22	-	-				
1700	"	369	10	43	39	264	8	-	-				
1800	"	238	6	42	35	346	14	-	-				
900	"	187	20	43	41	274	8	-	-				
2000	"	126	14	43	40	114	2	-	-				
2100	"	118	0	43	40	104	0	-	-				
2200	"	83	2	41	40	96	0	-	-				
2300	"	60	0	42	40	74	0	-	-				
0000	04/05/74	-	-	-	-	-	-	-	-				
0100	"	-	-	-	-	-	-	-	-				
0200	"	-	-	-	-	-	-	-	-				
0300	"	-	-	-	-	-	-	-	-				
0400	"	-	-	-	-	-	-	-	-				

*No radar data taken

TRAFFIC DATA

Route I-80, Section 1B & 2L (Netcong)

Hour	Date	Rt. 206 Northbound				Rt. 206 Southbound				Ramp			
		Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed Mph	Truck Speed Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed Mph	Truck Speed Mph	Auto Volume Veh/Hr	Truck Volume Veh/Hr	Auto Speed* Mph	Truck Speed* Mph
0500	04/05/74	26	4	39	35	58	6	-	-	0	4	-	-
0600	"	54	2	40	40	186	4	-	-	2	6	-	-
0700	"	236	14	40	40	516	10	-	-	56	13	-	-
0800	"	280	54	41	40	340	26	-	-	78	16	-	-
0900	"	184	16	40	43	194	22	-	-	60	26	-	-
1000	"	42	4	38	25	163	18	-	-	-	-	-	-

*No radar data taken

WEATHER DATA

Route I-80, Section 1B and 2L (Netcong)

Hour	Date	Wind Speed Mph	Wind Direction Degree	Temperature °F
1700	04/02/74	5	260	56
1800	04/02/74	5	260	56
1900	04/02/74	5	260	52
2000	04/02/74	0-3	260	50
2100	04/02/74	0-3	260	48
2200	04/02/74	0-3	260	46
2300	04/02/74	0-3	260	46
0000	04/03/74	0-3	250	45
0100	04/03/74	0-3	240	44
0200	04/03/74	0-3	240	44
0300	04/03/74	0-3	240	43
0400	04/03/74	0-3	240	40
0500	04/03/74	0-3	242	44
0600	04/03/74	0-3	242	44
0700	04/03/74	0-3	242	44
0800	04/03/74	0-3	242	48
0900	04/03/74	0-3	242	53
1000	04/03/74	0-3	210	55
1100	04/03/74	0-3	210	59
1200	04/03/74	0-3	210	60
1300	04/03/74	0-3	170	64

WEATHER DATA

Route I-80, Section 1B and 2L (Netcong)

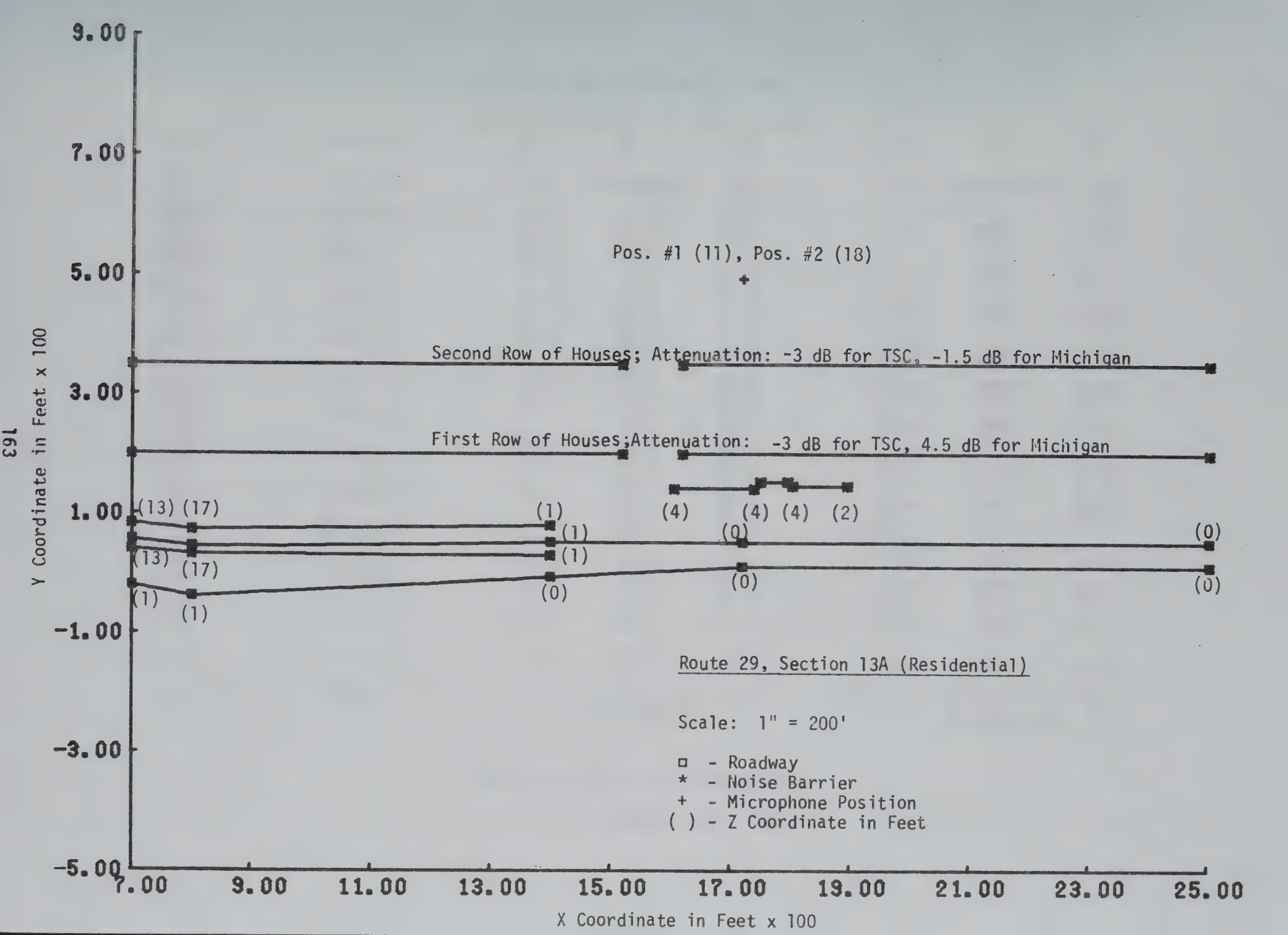
Hour	Date	Wind Speed Mph	Wind Direction Degree	Temperature °F
1400	04/03/74	0-3	215	65
1500	04/03/74	0-3	190	71
1600	04/03/74	0-3	165	69
1500	04/04/74	3	135	72
1600	04/04/74	3	135	70
1700	04/04/74	3	135	69
1800	04/04/74	3	135	68
1900	04/04/74	3	135	65
2000	04/04/74	3	180	63
2100	04/04/74	3	135	62
2200	04/04/74	3	135	62
2300	04/04/74	3	135	62
0000	04/05/74	3	135	62
0100	04/05/74	3	135	62
0200	04/05/74	3	135	60
0300	04/05/74	3	135	60
0400	04/05/74	3	135	60
0500	04/05/74	15	135	59
0600	04/05/74	15	135	60
0700	04/05/74	30	135	59
0800	04/05/74	30	180	60
0900	04/05/74	5	180	61

APPENDIX B

SITE PREDICTION

ROUTE 29, SECTION 13A

(RESIDENTIAL)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Y Coordinate in Feet x 100
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9.00
11.00
13.00
15.00
17.00
19.00
21.00
23.00
25.00
X Coordinate in Feet x 100
Pos. #1 (11), Pos. #2 (18)
Second Row of Houses; Attenuation: -3 dB for TSC, -1.5 dB for Michigan
First Row of Houses;Attenuation: -3 dB for TSC, 4.5 dB for Michigan
(13) (17)
(1)
(4) (4) (4) (2)
(0)
(13)
(17)
(1)
(1)
(0)
(0)
(0)
Route 29, Section 13A (Residential)
Scale: 1" = 200'
□ - Roadway
* - Noise Barrier
+ - Microphone Position
( ) - Z Coordinate in Feet

Observed and Predicted L_{10} (dBA)

Route 29, Section 13A (Residential)

Hour	Date	Position #1			Position #2		
		O	T	M	O	T	M
1200	10/16/73	54.9	58.7	56.4	56.2	58.6	56.5
1300	10/16/73	52.9	58.8	57.1	55.2	58.7	57.2
1400	10/16/73	55.1	58.8	57.3	56.5	58.8	57.4
1500	10/16/73	55.4	--	--	56.5	--	--
1600	10/16/73	54.6	56.0	57.4	55.9	56.1	57.5
1700	10/16/73	55.6	57.3	57.3	56.3	57.4	57.4
1800	10/16/73	--	55.5	55.3	53.9	55.6	55.4
1900	10/16/73	51.3	53.7	54.4	55.9	53.8	54.6
2000	10/16/73	50.4	50.5	52.4	54.3	50.7	52.6
2100	10/16/73	50.8	49.2	51.4	52.4	49.4	51.6
2200	10/16/73	46.5	48.7	51.6	49.4	49.0	51.7
2300	10/16/73	46.2	47.8	50.7	49.0	48.1	50.9
0000	10/17/73	48.1	45.6	49.7	47.9	45.9	49.8
0100	10/17/73	44.2	41.5	41.9	45.6	41.7	42.1

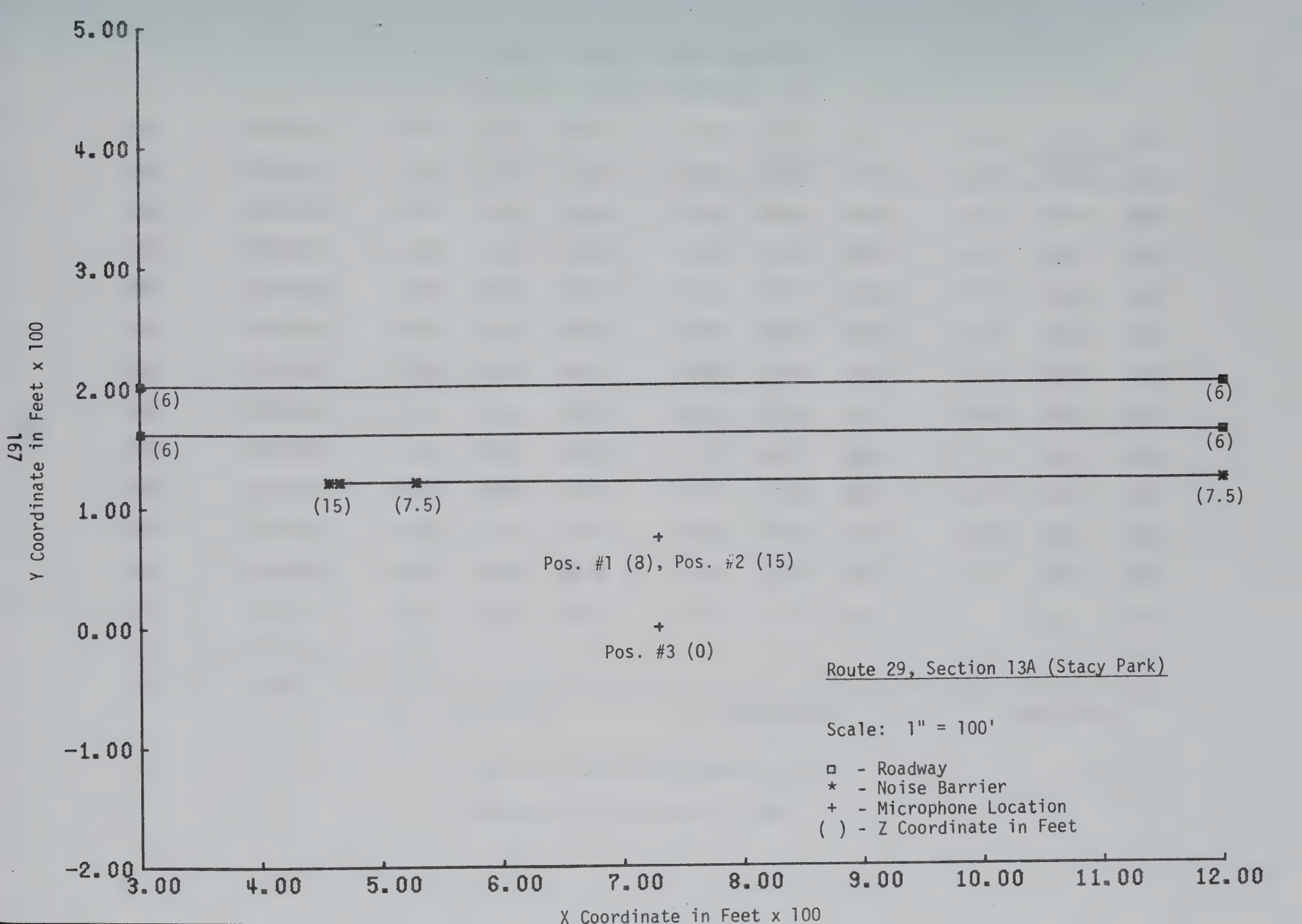
Observed and Predicted L_{10} (dBA)

Route 29, Section 13A (Residential)

Hour	Date	Position #1			Position #2		
		O	T	M	O	T	M
0200	10/17/73	46.4	40.6	40.2	47.8	40.8	40.4
0300	10/17/73	41.6	38.2	37.2	41.4	38.4	37.4
0400	10/17/73	45.3	40.9	37.4	44.3	41.0	37.6
0500	10/17/73	--	40.2	41.7	45.8	40.5	41.9
0600	10/17/73	48.4	48.3	51.3	50.4	48.6	51.4
0700	10/17/73	50.8	55.0	55.3	53.9	55.1	55.4
0800	10/17/73	56.1	57.1	57.5	56.2	57.2	57.6
0900	10/17/73	57.2	58.5	57.4	56.4	58.6	57.5
1000	10/17/73	54.7	58.2	56.4	54.6	58.2	56.5
1100	10/17/73	56.7	59.1	56.9	55.4	59.0	56.9

ROUTE 29, SECTION 13A

(STACY PARK)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7.00
8.00
9.00
10.00
11.00
12.00
Y Coordinate in Feet x 100
X Coordinate in Feet x 100
(6)
(6)
(6)
(6)
(15)
(7.5)
(7.5)
Pos. #1 (8), Pos. #2 (15)
Pos. #3 (0)
Route 29, Section 13A (Stacy Park)
Scale: 1" = 100'
□ - Roadway
* - Noise Barrier
+ - Microphone Location
( ) - Z Coordinate in Feet

Observed and Predicted L_{10} (dBA)

Route 29, Section 13A (Stacy Park)

Hour	Date	Position #1			Position #2			Position #3		
		O	T	M	O	T	M	O	T	M
1500	10/18/73	69.5	--	--	--	--	--	--	--	--
1600	10/18/73	69.4	75.9	73.5	70.7	77.2	73.5	--	72.7	66.3
1700	10/18/73	65.1	73.0	71.8	69.4	75.1	71.8	--	69.8	62.7
1800	10/18/73	65.2	71.7	70.6	67.7	73.5	70.6	58.7	68.7	61.2
1900	10/18/73	64.5	68.5	69.9	--	71.4	69.9	58.3	65.3	59.4
2000	10/18/73	--	68.9	69.0	--	71.1	69.0	--	66.0	58.6
2100	10/18/73	--	65.7	68.5	65.7	69.1	68.5	55.5	62.4	57.3
2200	10/18/73	64.3	64.1	68.3	65.0	68.3	68.3	--	60.4	56.9
2300	10/18/73	64.7	65.1	67.8	65.6	68.3	67.8	--	62.0	56.5
0000	10/19/73	65.0	61.3	67.2	66.1	66.1	67.2	--	57.2	55.5
0100	10/19/73	60.9	60.4	61.0	60.3	62.8	61.0	44.7	57.7	49.9
0200	10/19/73	58.2	54.8	59.0	58.9	59.5	59.0	44.4	49.9	48.0
0300	10/19/73	55.3	57.3	52.9	54.8	58.9	52.9	47.6	54.9	43.2
0400	10/19/73	56.6	57.0	53.8	56.6	58.8	53.8	48.3	54.6	44.2

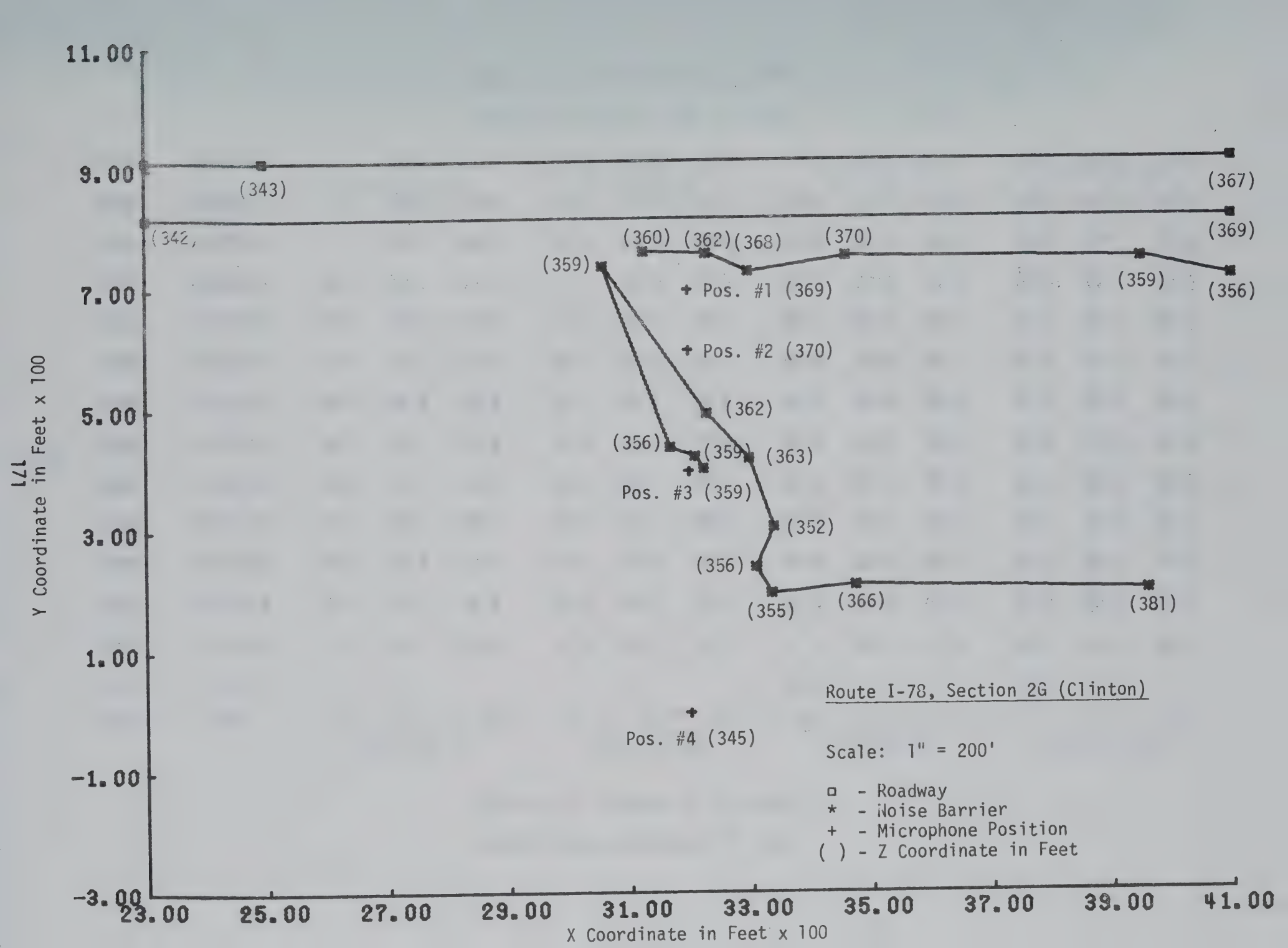
Observed and Predicted L_{10} (dBA)

Route 29, Section 13A (Stacy Park)

Hour	Date	Position #1			Position #2			Position #3		
		O	T	M	O	T	M	O	T	M
0500	10/19/73	60.8	61.5	59.6	61.2	63.1	59.6	--	58.9	49.1
0600	10/19/73	66.9	70.2	68.2	67.8	71.6	68.2	--	67.5	59.1
0700	10/19/73	69.4	73.9	71.4	70.1	75.2	71.4	50.1	71.0	63.6
0800	10/19/73	69.4	76.2	73.6	70.0	77.4	73.6	50.1	73.2	66.8
0900	10/19/73	66.2	75.4	72.4	67.9	76.3	72.4	53.0	72.4	65.7
1000	10/19/73	65.5	74.5	71.3	67.1	75.3	71.3	51.7	71.6	64.4
1100	10/19/73	66.2	76.9	73.8	67.9	77.3	73.8	53.1	73.9	68.0
1200	10/19/73	66.0	75.1	72.1	68.0	76.0	72.1	57.3	72.2	65.4
1300	10/19/73	65.2	75.7	72.5	67.5	76.4	72.5	55.8	72.7	66.1
1400	10/19/73	64.9	75.0	72.0	67.5	75.9	72.0	56.2	72.1	65.1

ROUTE I-78, SECTION 2G

(CLINTON)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Pos. #3 (359)
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Pos. #4 (345)
Route I-78, Section 2G (Clinton)
Scale: 1" = 200'
□ - Roadway
* - Noise Barrier
+ - Microphone Position
( ) - Z Coordinate in Feet

Observed and Predicted L_{10} (dBA)

Route I-78, Section 2G (Clinton)

Hour	Date	Position #1			Position #2			Position #3			Position #4		
		O	T	M	O	T	M	O	T	M	O	T	M
1500	11/01/73							73.6	--	--	70.0	--	--
1600	11/01/73	73.2	74.7	74.9	71.0	72.7	69.7	71.6	70.2	63.8	66.3	67.5	58.7
1700	11/01/73	72.8	74.1	74.2	68.9	72.1	69.0	69.4	69.5	63.0	63.6	66.9	57.8
1800	11/01/73	74.0	73.7	73.6	--	71.8	68.6	69.5	69.3	62.5	64.2	66.7	57.2
1900	11/01/73	--	73.5	72.7	70.0	71.7	68.3	69.7	69.2	62.4	64.4	66.7	57.3
2000	11/01/73	70.9	71.7	71.3	69.6	70.1	66.4	67.5	67.5	60.0	64.3	65.1	54.4
2100	11/01/73	70.7	71.5	70.7	70.8	69.9	66.0	67.9	67.3	59.9	61.2	64.9	54.3
2200	11/01/73	74.2	72.7	73.6	70.7	71.1	67.8	69.6	68.4	61.3	62.4	65.9	55.5
2300	11/01/73	72.4	72.7	73.5	68.3	71.2	67.7	67.5	68.5	61.3	61.8	66.0	55.6
0000	11/02/73	72.9	73.0	74.4	--	71.6	68.2	68.1	68.8	61.8	61.7	66.2	55.9
0100	11/02/73	72.5	73.1	74.2	--	71.6	68.2	68.2	68.9	61.8	60.4	66.3	55.9
0200	11/02/73	--	73.5	74.8	71.0	72.0	68.8	70.0	69.3	62.4	63.2	66.7	56.6
0300	11/02/73	--	74.3	75.6	73.3	72.8	69.7	70.2	70.0	63.3	63.7	67.3	57.6
0400	11/02/73	--	75.7	77.1	77.2	74.0	71.4	71.3	71.1	65.1	64.8	68.3	59.6

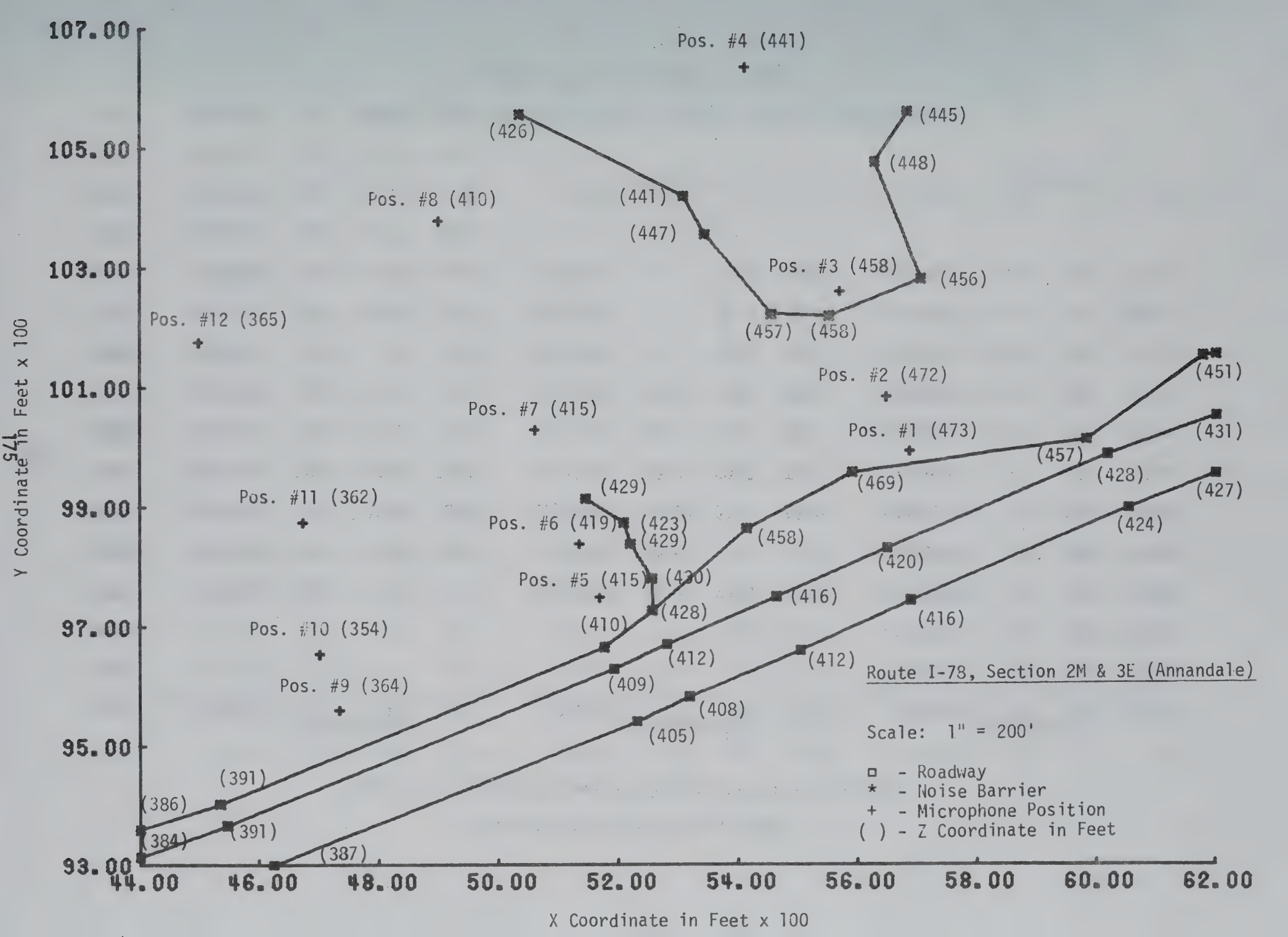
Observed and Predicted L_{10} (dBA)

Route I-78, Section 2G (Clinton)

Hour	Date	Position #1			Position #2			Position #3			Position #4		
		O	T	M	O	T	M	O	T	M	O	T	M
0500	11/02/73	--	76.1	77.5	76.0	74.3	71.9	72.3	71.5	65.6	66.6	68.7	60.2
0600	11/02/73	--	75.8	77.0	76.5	74.0	71.5	71.6	71.3	65.2	64.8	68.4	59.8
0700	11/02/73	--	76.6	77.6	72.7	74.6	72.3	68.6	71.8	66.2	63.0	69.0	60.9
0800	11/02/73	71.8	76.7	77.7	73.2	74.6	72.3	67.2	71.8	66.1	61.4	69.0	60.8
0900	11/02/73	72.0	76.0	76.7	71.2	74.0	71.3	66.5	71.4	75.3	59.7	68.6	60.1
1000	11/02/73	73.1	76.7	77.5	67.3	74.7	72.2	65.6	72.0	66.2	59.2	69.2	61.1
1100	11/02/73	71.9	76.8	77.3	67.4	74.7	72.2	63.7	72.1	66.3	59.1	69.3	61.3
1200	11/02/73	70.8	75.7	76.1	65.0	73.7	70.8	64.9	71.1	64.9	59.0	68.4	59.8
1300	11/02/73	71.9	76.4	77.0	67.3	74.4	71.8	67.0	71.8	65.9	62.5	69.0	60.9
1400	11/02/73	71.0	75.9	76.7	70.0	73.9	71.3	64.7	71.2	65.2	60.7	68.5	59.9

ROUTE I-78, SECTION 2M AND 3E

(ANNANDALE)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(441)
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Pos. #12 (365)
Pos. #2 (472)
(451)
Pos. #7 (415)
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(431)
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(427)
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Pos. #11 (362)
(424)
Pos. #6 (419)
(423)
(429)
(458)
(420)
Pos. #5 (415)
(430)
(416)
(428)
(410)
(416)
Pos. #10 (354)
(412)
(412)
(409)
Pos. #9 (364)
(408)
(405)
(391)
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(391)
(387)
Route I-78, Section 2M & 3E (Annandale)
Scale: 1" = 200'
□ - Roadway
* - Noise Barrier
+ - Microphone Position
( ) - Z Coordinate in Feet
107.00
105.00
103.00
101.00
99.00
97.00
95.00
93.00
44.00
46.00
48.00
50.00
52.00
54.00
56.00
58.00
60.00
62.00
Y Coordinate in Feet x 100
X Coordinate in Feet x 100

Observed and Predicted L_{10} (dBA)

Route I-78, Section 2M and 3E Station 127+00 (Annandale)

Hour	Position #1				Position #2				Position #3			
	Date	O	T	M	Date	O	T	M	Date	O	T	M
1400									01/29/74	--	68.6	53.2
1500									01/29/74	--	67.6	51.7
1600	12/04/73	80.2	--	--	12/11/73	60.0	72.9	63.2	01/29/74	--	67.3	51.5
1700	12/04/73	80.1	77.6	74.0	12/11/73	59.6	--	--	01/29/74	--	67.4	52.1
1800	12/04/73	78.2	76.6	73.0	12/11/73	60.0	71.1	61.3	01/29/74	--	66.7	50.7
1900	12/04/73	78.8	76.6	72.9	12/11/73	59.4	69.8	59.0	01/29/74	--	67.3	51.5
2000	12/04/73	77.7	75.0	70.4	12/11/73	59.6	69.7	59.7	01/29/74	59.7	64.3	47.4
2100	12/04/73	76.8	--	--	12/11/73	58.9	70.1	59.2	01/29/74	59.9	66.6	50.7
2200	12/04/73	77.0	--	--	12/11/73	--	70.6	59.6	01/29/74	61.0	64.2	47.3
2300	12/04/73	79.5	76.4	72.1	12/11/73	--	70.7	58.8	01/29/74	62.2	67.0	50.7
0000	12/05/73	78.2	74.0	68.2	12/12/73	--	70.4	58.4	01/30/74	62.3	64.6	47.7
1400	12/06/73	80.4	79.1	75.5								
1500	12/06/73	80.5	79.1	75.6								
1600	12/06/73	82.2	79.0	75.6								
1700	12/06/73	77.3	78.6	75.3								

Observed and Predicted L_{10} (dBA)

Route I-78, Section 2M and 3E Station 127+00 (Annandale)

Hour	Position #1				Position #2				Position #3			
	Date	O	T	M	Date	O	T	M	Date	O	T	M
1800	12/06/73	78.4	78.0	74.5								
1900	12/06/73	79.1	76.4	72.6								
2000	12/06/73	77.2	75.9	71.7								
2100	12/06/73	--	74.9	70.4								
2200	12/06/73	76.6	74.0	68.1								
2300	12/06/73	76.1	75.5	70.8								
0000	12/07/73	75.4	75.2	70.0								
0100	12/07/73	75.8	74.9	69.4	12/12/73	62.4	71.1	59.2	01/30/74	63.9	65.5	48.8
0200	12/07/73	77.2	73.9	67.5	12/12/73	61.6	71.3	59.3	01/30/74	64.2	67.1	50.8
0300	12/07/73	73.7	75.6	69.8	12/12/73	63.9	72.4	60.5	01/30/74	62.9	65.9	49.3
0400	12/07/73	81.1	75.6	70.1	12/12/73	63.4	72.9	61.0	01/30/74	62.5	67.3	50.9
0500	12/07/73	77.9	77.0	72.8	12/12/73	61.9	73.7	61.8	01/30/74	63.0	66.3	49.7
0600	12/07/73	80.8	78.1	74.1	12/12/73	--	73.8	62.3	01/30/74	63.1	67.1	50.7
0700	12/07/73	79.7	78.6	74.9	12/12/73	65.7	74.5	63.2	01/30/74	60.9	67.0	50.9

Observed and Predicted L_{10} (dBA)

Route I-78, Section 2M and 3E Station 127+00 (Annandale)

Hour	Position #1				Position #2				Position #3			
	Date	O	T	M	Date	O	T	M	Date	O	T	M
0800	12/07/73	79.7	78.0	74.0	12/12/73	62.3	73.7	62.8	01/30/74	60.6	68.1	52.3
0900	12/07/73	81.5	79.5	76.0	12/12/73	63.3	73.7	63.3	01/30/74	--	69.3	54.0
1000	12/07/73	81.2	79.6	76.2	12/12/73	64.6	--	--	01/30/74	--	68.9	53.3
1100	12/07/73	--	79.2	75.7	12/12/73	63.7	74.2	64.1	01/30/74	--	69.5	54.2
1200	12/07/73	--	--	--	12/12/73	61.6	--	--	01/30/74	--	70.4	55.5
1300	12/07/73	--	79.5	76.0	12/12/73	62.4	73.9	63.7	01/30/74	--	--	--
1400					12/12/73	62.5	73.1	63.2				
1500					12/12/73	60.6	72.5	63.4				

Observed and Predicted L_{10} (dBA)

Route I-78, Section 2M and 3E Station 127+00 (Annandale)

Position #4					Position #4					Position #4				
Hour	Date	O	T	M	Hour	Date	O	T	M	Hour	Date	O	T	M
1200	02/28/74	--	64.8	53.0	2200	02/28/74	--	62.1	49.9	0800	03/01/74	--	66.1	54.8
1300	02/28/74	--	64.9	53.3	2300	02/28/74	--	59.6	48.0	0900	03/01/74	--	65.9	54.5
1400	02/28/74	--	65.5	54.1	0000	03/01/74	--	64.9	52.8	1000	03/01/74	--	65.9	54.7
1500	02/28/74	--	65.8	54.4	0100	03/01/74	--	65.2	53.3	1100	03/01/74	--	67.4	56.5
1600	02/28/74	--	66.8	55.9	0200	03/01/74	--	62.5	50.4	1200	03/01/74	--	66.0	54.9
1700	02/28/74	56.9	67.0	56.3	0300	03/01/74	--	66.0	54.4	1300	03/01/74	--	66.0	54.7
1800	02/28/74	54.9	65.0	53.8	0400	03/01/74	--	66.8	55.5	1400	03/01/74	--	66.6	55.7
1900	02/28/74	60.6	64.4	52.5	0500	03/01/74	--	64.6	52.7	1500	03/01/74	--	66.9	55.8
2000	02/28/74	59.6	64.1	52.5	0600	03/01/74	--	65.6	54.0	1600	03/01/74	--	67.0	56.4
2100	02/28/74	--	62.2	52.0	0700	03/01/74	--	66.8	55.8	1700	03/01/74	--	66.7	56.6

Observed and Predicted L_{10} (dBA)

Route I-78, Section 2M and 3E Station 121+25 (Annandale)

Hour	Position #5				Position #6				Position #7			
	Date	O	T	M	Date	O	T	M	Date	O	T	M
1400									01/29/74	61.9	70.1	62.3
1500									01/29/74	64.9	68.7	61.0
1600					12/11/73	69.1	73.6	68.2	01/29/74	63.1	68.9	60.7
1700	12/04/73	--	78.2	71.8	12/11/73	67.3	--	--	01/29/74	64.2	69.2	61.2
1800	12/04/73	--	77.8	70.9	12/11/73	67.9	72.0	66.3	01/29/74	62.9	67.8	60.0
1900	12/04/73	--	78.0	70.9	12/11/73	66.5	69.6	64.2	01/29/74	--	69.2	60.6
2000	12/04/73	--	75.9	68.2	12/11/73	62.6	70.6	64.7	01/29/74	63.6	65.5	56.7
2100	12/04/73	69.0	--	--	12/11/73	--	70.0	64.4	01/29/74	63.7	68.5	59.8
2200	12/04/73	--	--	--	12/11/73	--	70.4	64.8	01/29/74	64.5	64.5	56.7
2300	12/04/73	--	77.0	70.0	12/11/73	--	69.4	64.0	01/29/74	--	68.1	60.0
0000	12/05/73	61.4	73.7	65.9	12/12/73	--	69.1	63.7	01/30/74	63.6	64.6	57.2
1400	12/06/73	72.9	79.9	73.5								
1500	12/06/73	--	80.2	73.6								
1600	12/06/73	70.3	80.1	73.6								

Observed and Predicted L_{10} (dBA)

Route I-78, Section 2M and 3E Station 121+25 (Annandale)

Hour	Position #5				Position #6				Position #7			
	Date	O	T	M	Date	O	T	M	Date	O	T	M
1700	12/06/73	72.1	80.1	73.4								
1800	12/06/73	71.7	79.3	72.6								
1900	12/06/73	70.3	77.6	70.5								
2000	12/06/73	70.4	76.7	69.5								
2100	12/06/73	68.9	75.9	68.1								
2200	12/06/73	67.6	73.2	65.8								
2300	12/06/73	67.8	76.0	68.6								
0000	12/07/73	66.8	75.2	67.7								
0100	12/07/73	68.5	74.6	67.1	12/12/73	--	69.9	64.5	01/30/74	64.5	66.7	58.0
0200	12/07/73	68.7	72.5	65.2	12/12/73	--	69.9	64.6	01/30/74	--	68.1	60.1
0300	12/07/73	69.0	74.2	67.4	12/12/73	--	70.8	65.8	01/30/74	65.1	65.4	58.9
0400	12/07/73	73.3	74.8	67.8	12/12/73	--	71.1	66.3	01/30/74	63.3	67.5	60.4
0500	12/07/73	73.0	77.0	70.6	12/12/73	--	71.6	67.2	01/30/74	66.8	67.2	59.0
0600	12/07/73	72.0	78.5	72.0	12/12/73	--	72.2	67.6	01/30/74	64.1	67.3	60.2
0700	12/07/73	73.6	78.9	72.8	12/12/73	--	72.7	68.5	01/30/74	64.6	67.7	60.3

Observed and Predicted L_{10} (dBA)

Route I-78, Section 2M and 3E Station 121+25 (Annandale)

Hour	Postion #5				Position #6				Position #7			
	Date	O	T	M	Date	O	T	M	Date	O	T	M
0800	12/07/73	69.7	77.8	71.8	12/12/73	--	72.9	68.0	01/30/74	66.0	68.4	61.8
0900	12/07/73	72.1	80.3	74.0	12/12/73	--	73.5	68.5	01/30/74	65.3	70.2	63.3
1000	12/07/73	71.7	80.6	74.1	12/12/73	--	--	--	01/30/74	65.0	69.4	62.7
1100	12/07/73	72.2	79.9	73.6	12/12/73	--	74.2	69.2	01/30/74	66.2	70.5	63.5
1200	12/07/73	71.2	--	--	12/12/73	--	--	--	01/30/74	67.2	71.8	64.7
1300	12/07/73	73.6	80.5	74.0	12/12/73	--	73.9	68.8	01/30/74	--	--	--
1400					12/12/73	--	73.7	68.2				
1500					12/12/73	--	73.9	68.4				

Observed and Predicted L_{10} (dBA)

Route I-78, Section 2M and 3E Station 121+25 (Annandale)

Position #8					Position #8					Position #8				
Hour	Date	O	T	M	Hour	Date	O	T	M	Hour	Date	O	T	M
1200	02/28/74	--	65.3	54.9	2200	02/28/74	58.4	63.2	51.8	0800	03/01/74	--	66.3	56.8
1300	02/28/74	--	65.7	55.2	2300	02/28/74	--	61.8	49.6	0900	03/01/74	61.2	66.4	56.4
1400	02/28/74	--	66.2	56.0	0000	03/01/74	60.3	64.8	55.0	1000	03/01/74	--	67.1	56.4
1500	02/28/74	--	66.6	56.3	0100	03/01/74	62.2	65.6	55.3	1100	03/01/74	61.5	68.4	58.3
1600	02/28/74	62.8	67.8	57.7	0200	03/01/74	63.3	64.0	52.2	1200	03/01/74	60.9	67.3	56.6
1700	02/28/74	63.4	68.3	58.0	0300	03/01/74	62.5	65.4	56.6	1300	03/01/74	66.5	66.9	56.6
1800	02/28/74	--	66.5	55.5	0400	03/01/74	64.0	66.3	57.7	1400	03/01/74	61.1	67.8	57.4
1900	02/28/74	60.4	65.0	54.5	0500	03/01/74	59.3	65.1	54.7	1500	03/01/74	60.7	67.7	57.7
2000	02/28/74	--	64.2	54.5	0600	03/01/74	62.2	65.4	56.2	1600	03/01/74	--	68.3	58.1
2100	02/28/74	--	63.2	54.1	0700	03/01/74	60.4	66.4	57.9	1700	03/01/74	--	68.5	58.1

Observed and Predicted L_{10} (dBA)

Route I-78, Section 2M and 3E Station 116+50 (Annandale)

Hour	Position #9				Position #10				Position #11			
	Date	O	T	M	Date	O	T	M	Date	O	T	M
1400									01/29/74	61.7	71.7	62.8
1500									01/29/74	64.5	70.1	60.6
1600	12/04/73	67.2	--	--	12/11/73	64.5	64.4	63.7	01/29/74	62.5	70.6	**61.0**
1700	12/04/73	66.6	63.6	64.4	12/11/73	63.7	--	--	01/29/74	63.2	70.8	61.5
1800	12/04/73	67.6	62.7	63.9	12/11/73	64.7	62.6	61.8	01/29/74	--	69.3	59.4
1900	12/04/73	65.7	62.8	64.1	12/11/73	63.9	60.1	59.2	01/29/74	--	70.9	61.4
2000	12/04/73	68.4	60.6	61.1	12/11/73	63.9	61.0	60.4	01/29/74	69.7	67.1	56.4
2100	12/04/73	65.0	--	--	12/11/73	63.7	60.6	59.7	01/29/74	63.7	70.2	60.6
2200	12/04/73	--	--	--	12/11/73	62.2	61.0	60.0	01/25/74	--	65.7	55.2
2300	12/04/73	65.5	62.2	62.9	12/11/73	62.0	60.2	58.6	01/29/74	--	69.5	59.7
0000	12/05/73	--	59.0	57.8	12/12/73	61.4	59.8	58.3	01/30/74	61.0	65.6	55.3
1400	12/06/73	65.9	65.6	66.4								
1500	12/06/73	65.2	65.7	66.6								
1600	12/06/73	64.7	65.6	66.6								
1700	12/06/73	65.3	65.3	66.5								

Observed and Predicted L_{10} (dBA)

Route I-78, Section 2M and 3E Station 116+50 (Annandale)

Hour	Position #9				Position #10				Position #11			
	Date	O	T	M	Date	O	T	M	Date	O	T	M
1800	12/06/73	64.2	64.4	65.6								
1900	12/06/73	64.6	62.5	63.6								
2000	12/06/73	65.2	61.7	62.4								
2100	12/06/73	64.8	60.6	61.1								
2200	12/06/73	60.4	58.7	57.1								
2300	12/06/73	61.9	61.1	61.2								
0000	12/07/73	61.2	60.5	60.0								
0100	12/07/73	61.3	60.0	59.1	12/12/73	62.7	60.7	59.3	01/30/74	--	68.3	57.9
0200	12/07/73	58.9	58.3	56.2	12/12/73	62.1	60.7	59.2	01/30/74	61.9	69.6	59.8
0300	12/07/73	63.5	60.5	58.7	12/12/73	64.1	61.8	60.2	01/30/74	--	66.2	56.3
0400	12/07/73	66.4	60.6	59.4	12/12/73	63.4	62.3	60.5	01/30/74	--	68.7	58.9
0500	12/07/73	65.5	62.9	62.9	12/12/73	62.8	63.0	61.0	01/30/74	64.3	68.7	58.5
0600	12/07/73	65.0	64.2	64.8	12/12/73	--	63.5	61.8	01/30/74	--	68.5	58.6
0700	12/07/73	64.0	64.8	65.4	12/12/73	--	64.2	62.3	01/30/74	--	69.0	59.1
0800	12/07/73	61.2	63.8	64.0	12/12/73	64.7	64.0	62.6	01/30/74	--	69.6	60.2

Observed and Predicted L_{10} (dBA)

Route I-78, Section 2M and 3E Station 116+50 (Annandale)

Hour	Position #9				Position #10				Position #11			
	Date	O	T	M	Date	O	T	M	Date	O	T	M
0900	12/07/73	63.9	66.1	66.8	12/12/73	65.5	64.6	63.5	01/30/74	--	71.5	62.7
1000	12/07/73	62.7	66.3	67.1	12/12/73	66.5	--	--	01/30/74	--	70.7	61.6
1100	12/07/73	63.0	65.7	66.4	12/12/73	66.6	65.3	64.5	01/30/74	64.6	71.9	63.2
1200	12/07/73	62.9	--	--	12/12/73	66.4	--	--	01/30/74	65.6	73.2	65.1
1300	12/07/73	63.1	66.2	67.0	12/12/73	65.7	65.0	64.1	01/30/74	63.8	--	--
1400					12/12/73	66.9	64.6	63.9				
1500					12/12/73	65.2	64.7	64.3				

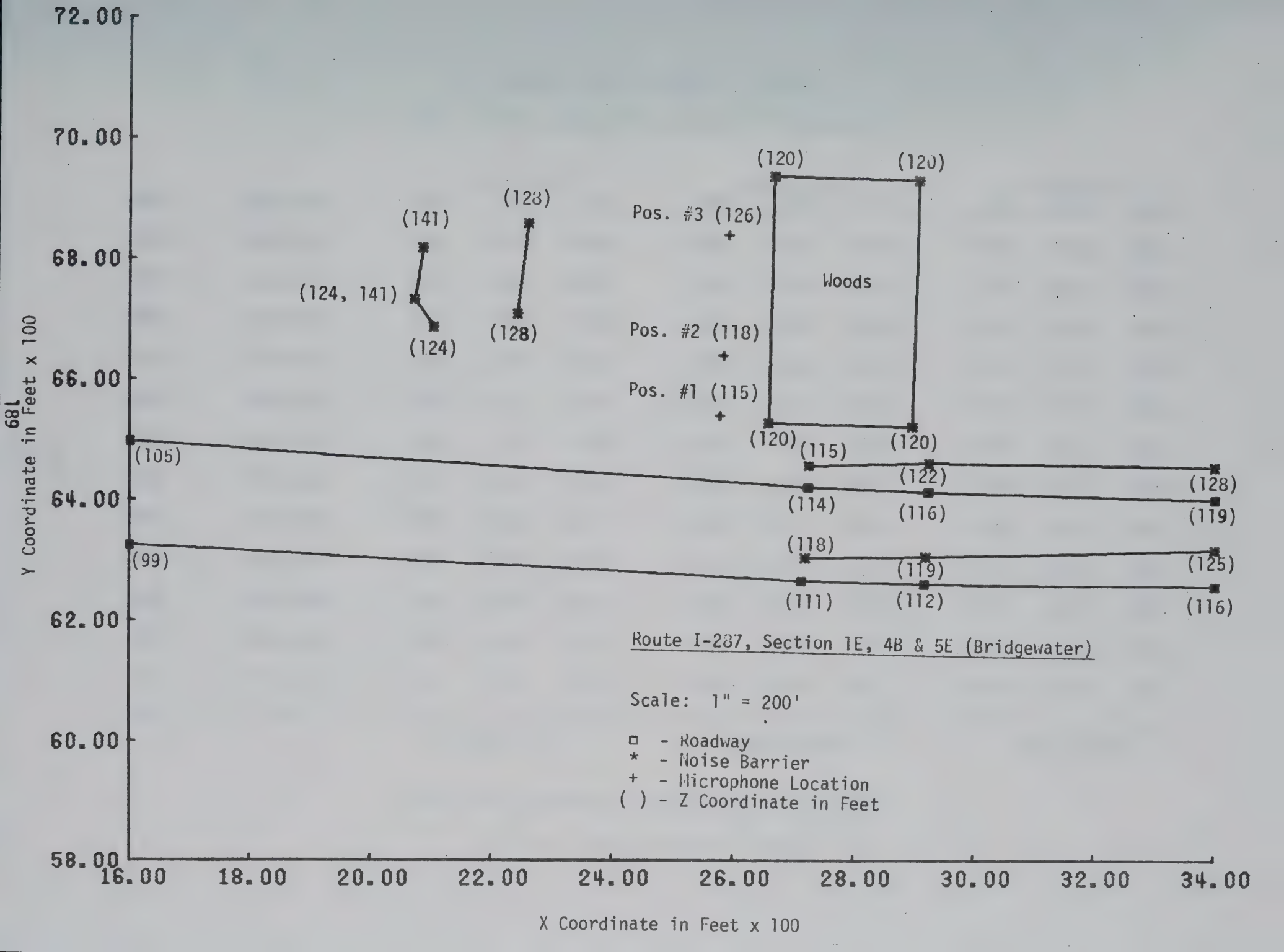
Observed and Predicted L_{10} (dBA)

Route I-78, Section 2M and 3E Station 116+50 (Annandale)

Position #12					Position #12					Position #12				
Hour	Date	O	T	M	Hour	Date	O	T	M	Hour	Date	O	T	M
1200	02/28/74	--	67.1	55.7	2200	02/28/74	56.3	65.2	52.8	0800	03/01/74	60.1	67.9	57.5
1300	02/28/74	--	67.4	56.1	2300	02/28/74	--	64.2	50.8	0900	03/01/74	59.1	68.0	57.3
1400	02/28/74	--	67.9	56.8	0000	03/01/74	58.1	66.4	55.8	1000	03/01/74	58.4	68.9	57.6
1500	02/28/74	--	68.3	57.2	0100	03/01/74	60.2	67.3	56.3	1100	03/01/74	59.1	70.1	59.4
1600	02/28/74	60.7	69.5	58.7	0200	03/01/74	59.3	66.1	53.5	1200	03/01/74	57.5	69.1	57.7
1700	02/28/74	--	70.0	59.1	0300	03/01/74	60.0	66.8	57.4	1300	03/01/74	62.0	68.7	57.5
1800	02/28/74	--	68.4	56.6	0400	03/01/74	59.9	67.6	58.4	1400	03/01/74	57.4	69.5	58.5
1900	02/28/74	--	66.8	55.4	0500	03/01/74	60.1	66.8	55.6	1500	03/01/74	58.9	69.3	58.6
2000	02/28/74	--	65.8	54.9	0600	03/01/74	60.0	66.8	56.8	1600	03/01/74	59.5	70.0	59.1
2100	02/28/74	--	65.2	52.9	0700	03/01/74	58.4	67.7	58.4	1700	03/01/74	--	70.3	59.3

ROUTE I-287, SECTION 1E, 4B AND 5B

(BRIDGEWATER)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70.00
68.00
66.00
64.00
62.00
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58.00
16.00
18.00
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32.00
34.00
Y Coordinate in Feet x 100
X Coordinate in Feet x 100
(141)
(128)
(124, 141)
(124)
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Pos. #3 (126)
Pos. #2 (118)
Pos. #1 (115)
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(116)
Route I-287, Section 1E, 4B & 5E (Bridgewater)
Scale: 1" = 200'
□ - Roadway
* - Noise Barrier
+ - Microphone Location
( ) - Z Coordinate in Feet

Observed and Predicted L_{10} (dBA)

Route I-287, Section 1E, 4B and 5B (Bridgewater)

Hour	Date	Position #1			Position #2			Position #3		
		O	T	M	O	T	M	O	T	M
1200	03/14/74	77.0	80.4	76.6	66.5	77.1	70.7	52.6	73.0	64.7
1300	03/14/73	76.9	79.9	76.1	67.5	76.6	70.1	51.5	72.6	64.0
1400	03/14/74	77.6	80.3	76.5	67.8	76.9	70.5	52.8	72.8	64.3
1500	03/14/74	76.6	79.6	75.5	68.1	76.3	69.8	53.4	72.3	63.7
1600	03/14/74	76.9	80.0	76.4	69.1	76.7	70.3	54.3	72.5	64.1
1700	03/14/74	76.1	79.1	75.5	68.3	75.8	69.2	53.8	71.7	62.9
1800	03/14/74	75.3	77.2	73.1	67.7	74.1	67.3	53.3	70.1	60.8
1900	03/14/74	74.6	77.7	73.8	67.4	74.5	67.6	53.3	70.5	60.9
2000	03/14/74	74.3	76.8	72.5	66.3	73.7	66.5	51.8	69.7	59.7
2100	03/14/74	72.4	75.2	69.8	65.9	72.2	64.6	51.6	68.4	58.0
2200	03/14/74	70.6	74.7	68.8	63.6	71.8	63.9	52.7	68.1	57.8
2300	03/14/74	73.0	75.0	68.6	65.8	72.2	63.9	53.3	68.5	58.4
0000	03/15/74	75.1	76.0	70.6	68.6	73.0	65.3	53.7	69.1	58.9

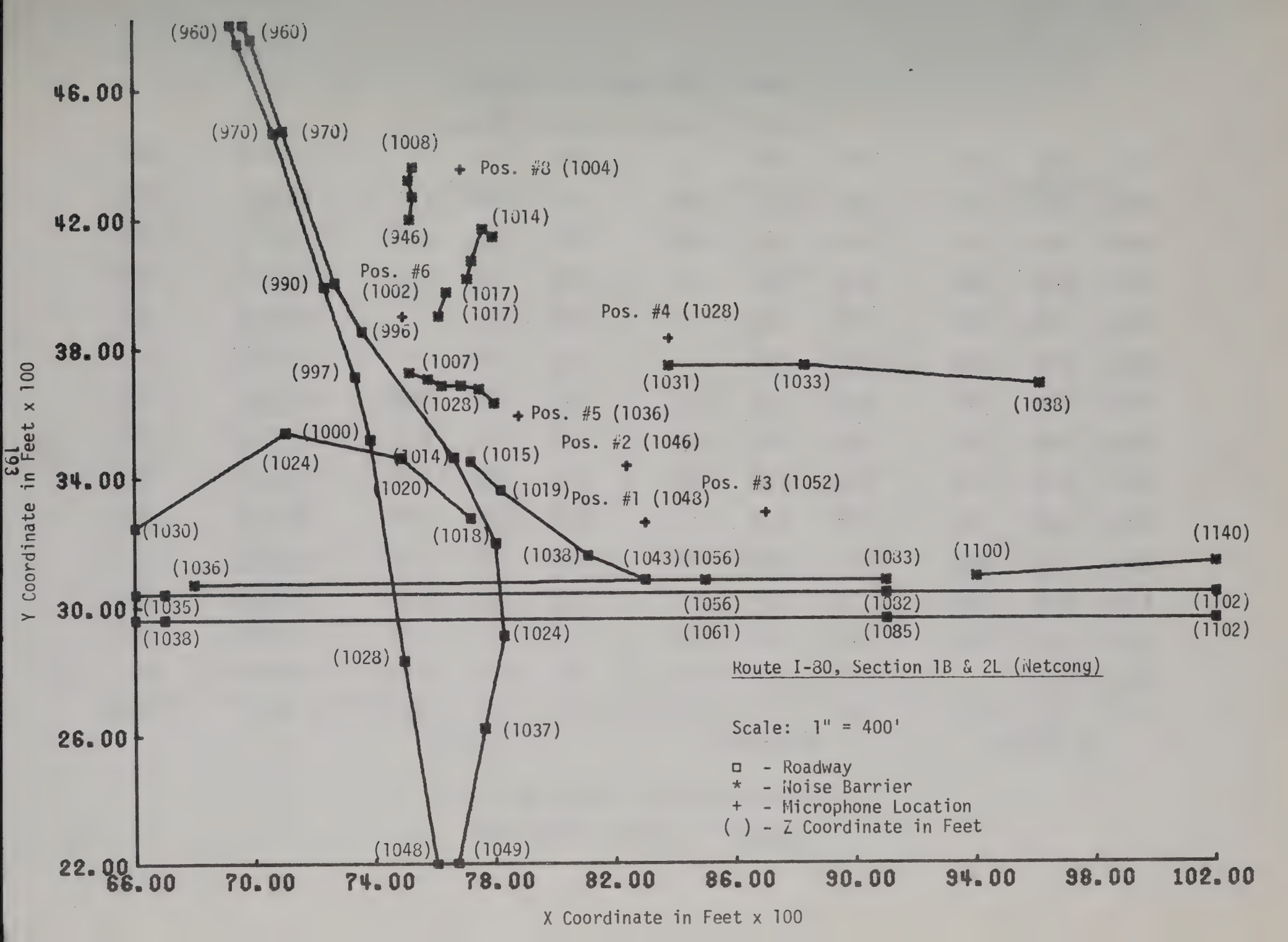
Observed and Predicted L_{10} (dBA)

Route I-287, Section 1E, 4B and 5B (Bridgewater)

Hour	Date	Position #1			Position #2			Position #3		
		O	T	M	O	T	M	O	T	M
0100	03/15/74	71.1	74.6	67.8	65.7	71.9	63.3	51.1	68.2	58.0
0200	03/15/74	70.9	75.3	69.2	64.2	72.4	64.3	49.7	68.6	58.3
0300	03/15/74	74.6	76.9	71.8	67.6	73.9	66.3	53.6	70.0	60.1
0400	03/15/74	75.3	77.0	71.6	69.3	74.1	66.6	55.3	70.3	60.9
0500	03/15/74	76.2	78.1	73.4	70.3	75.1	67.9	57.3	71.3	62.4
0600	03/15/74	76.8	77.9	73.2	69.4	74.9	67.8	54.9	71.1	62.2
0700	03/15/74	76.2	76.7	70.8	69.5	73.9	66.7	55.2	70.3	62.1
0800	03/15/74	74.7	79.3	75.4	66.5	76.1	69.6	49.5	72.2	64.1
0900	03/15/74	76.2	81.4	77.8	67.4	78.0	72.1	49.8	73.9	66.0
1000	03/15/74	77.0	81.1	77.4	68.3	77.7	71.7	50.0	73.6	65.6
1100	03/15/74	77.1	80.1	76.4	68.7	76.8	70.4	51.3	72.7	64.2

ROUTE I-80, SECTION 1B AND 2L

(NETCONG)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(970) (970)
(1008)
Pos. #8 (1004)
(1014)
(946)
Pos. #6
(1002)
(990)
(1017)
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(996)
Pos. #4 (1028)
(1007)
(997)
(1031)
(1033)
(1038)
(1028)
Pos. #5 (1036)
(1000)
Pos. #2 (1046)
(1024)
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(1020)
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Pos. #1 (1048)
Pos. #3 (1052)
(1030)
(1018)
(1140)
(1038)
(1043)
(1056)
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(1100)
(1036)
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(1085)
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(1028)
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(1048)
(1049)
Route I-80, Section 1B & 2L (Netcong)
Scale: 1" = 400'
□ - Roadway
* - Noise Barrier
+ - Microphone Location
( ) - Z Coordinate in Feet
46.00
42.00
38.00
34.00
30.00
26.00
22.00
66.00
70.00
74.00
78.00
82.00
86.00
90.00
94.00
98.00
102.00
Y Coordinate in Feet x 100
X Coordinate in Feet x 100

Observed and Predicted L_{10} (dBA)

Route I-80, Section 1B and 2L (Netcong)

Hour	Date	Position #1			Position #2			Position #4		
		O	T	M	O	T	M	O	T	M
1700	04/02/74	66.4	71.3	70.5	59.9	63.1	65.9	--	59.1	59.1
1800	04/02/74	66.9	70.7	69.5	58.6	62.6	64.9	58.6	58.6	58.3
1900	04/02/74	66.8	68.5	67.1	60.5	60.6	62.3	56.3	56.6	55.3
2000	04/02/74	65.7	69.7	68.0	60.4	61.0	63.0	56.8	57.7	54.3
2100	04/02/74	69.4	69.9	68.0	--	61.8	63.1	59.4	57.8	56.6
2200	04/02/74	64.8	69.3	67.6	59.1	61.3	62.5	57.4	57.3	55.6
2300	04/02/74	70.6	71.1	69.5	61.9	63.0	64.7	57.9	59.0	58.4
0000	04/03/74	69.3	70.4	68.0	61.6	62.4	63.9	57.7	58.6	58.1
0100	04/03/74	--	70.2	67.7	--	62.2	63.4	59.2	58.4	57.5
0200	04/03/74	--	71.2	69.0	--	63.1	64.6	60.9	59.2	58.8
0300	04/03/74	--	70.1	67.5	--	62.2	63.3	59.6	58.3	57.5
0400	04/03/74	65.4	70.8	68.3	62.9	62.8	64.4	60.9	59.0	58.8
0500	04/03/74	67.6	70.4	68.1	64.2	62.4	63.7	62.2	58.5	57.8
0600	04/03/74	--	71.0	69.0	--	63.0	65.0	61.0	59.2	59.4

Observed and Predicted L_{10} (dBA)

Route I-80, Section 1B and 2L (Netcong)

Hour	Date	Position #1			Position #2			Position #4		
		O	T	M	O	T	M	O	T	M
0700	04/03/74	64.8	72.2	71.7	61.8	64.3	67.3	61.4	60.4	61.8
0800	04/03/74	67.0	72.6	71.5	60.5	64.5	67.3	59.5	60.6	61.5
0900	04/03/74	--	72.9	71.9	--	64.7	67.3	59.3	60.7	61.3
1000	04/03/74	--	73.9	73.2	--	65.7	68.8	60.1	61.8	63.0
1100	04/03/74	70.6	73.4	72.5	62.8	65.2	68.0	--	61.3	62.2
1200	04/03/74	72.5	72.6	71.5	64.3	64.4	66.8	62.2	60.5	60.8
1300	04/03/74	--	73.0	72.2	68.7	64.8	67.5	62.4	60.9	61.5
1400	04/03/74	--	72.9	71.9	67.5	64.8	67.3	63.4	60.8	61.4
1500	04/03/74	71.5	71.7	70.5	--	63.6	65.7	62.0	59.5	59.4
1600	04/03/74	71.1	72.0	70.9	67.9	63.9	66.4	63.0	59.9	60.1

Observed and Predicted L_{10} (dBA)

Route I-80, Section 1B and 2L (Netcong)

Hour	Date	Position #5			Position #8		
		O	T	M	O	T	M
1500	04/04/74	59.1	66.1	63.9	54.9	67.9	58.1
1600	04/04/74	58.5	62.9	59.3	54.9	64.8	58.1
1700	04/04/74	--	60.0	57.1	54.8	61.4	51.9
1800	04/04/74	--	59.8	56.0	--	62.0	52.7
1900	04/04/74	54.0	61.6	58.0	54.9	62.8	52.4
2000	04/04/74	58.8	59.5	55.2	53.3	60.4	49.0
2100	04/04/74	53.1	48.1	49.9	52.8	48.5	43.7
2200	04/04/74	55.9	50.8	48.3	53.9	51.7	42.5
2300	04/04/74	55.5	45.6	46.6	54.4	46.3	40.7
0000	04/05/75	57.2	--	--	53.0	--	--
0100	04/05/74	58.6	--	--	54.4	--	--
0200	04/05/74	52.3	--	--	54.2	--	--
0300	04/05/74	50.8	--	--	54.5	--	--
0400	04/05/74	53.7	--	--	55.2	--	--

Observed and Predicted L_{10} (dBA)

Route I-80, Section 1B and 2L (Netcong)

Hour	Date	Position #5			Position #8		
		O	T	M	O	T	M
0500	04/05/74	52.9	56.5	48.3	55.3	58.7	45.3
0600	04/05/74	53.6	54.4	49.5	55.5	56.8	45.2
0700	04/05/74	54.6	61.3	57.8	56.9	62.9	52.9
0800	04/05/74	--	66.3	63.7	56.9	67.4	57.2
0900	04/05/74	--	62.5	58.8	55.3	64.4	53.5
1000	04/05/74	53.7	60.6	54.5	--	63.4	53.4

APPENDIX C

STATISTICAL TABLES

OBSERVED VS. TSC PREDICTED L_{10}

SITE ELEMENTARY STATISTICS FOR DIFFERENCES

OBSERVED VS TSC PREDICTED L_{10}

Site	Average Difference $\bar{d}$	Std. Dev. of Differences	t-Statistic for $\bar{d} = 0$	Degrees of Freedom	$\bar{d} = 0$? 95% Confidence
R12	0.0	3.1	0.06	43	yes
S123	-7.2	6.1	8.92	56	no
C1234	-2.9	3.2	8.15	81	no
A1234	-3.6	5.5	5.08	59	no
A5678	-5.1	2.5	16.20	64	no
A9101112	-2.2	5.1	3.79	74	no
B123	-5.1	2.7	12.81	47	no
N124	-0.7	2.6	1.93	53	yes
N58	-3.2	6.2	2.57	23	no

SITE LINEAR REGRESSION BETWEEN

OBSERVED AND TSC PREDICTED L_{10}

Site	Regression Coefficient	Regression Coeff. = + 1?	Intercept	F-test	Degrees of Freedom	Correlation	Std. Error of Estimate
R12	0.619	no	19.550	327.7	42	0.941	1.6
S123	0.616	no	19.189	40.4	55	0.651	5.4
C1234	1.009	yes	-3.514	76.0	80	0.698	3.2
A1234	1.535	no	-42.389	134.0	58	0.835	4.9
A5678	0.694	no	16.614	222.6	63	0.883	2.0
A9101112	-0.180	no	74.555	4.3	73	-0.235	2.7
B123	1.317	no	-29.326	76.5	46	0.790	2.7
N124	0.712	no	17.723	153.7	52	0.864	2.1
N58	0.112	no	48.584	4.8	22	0.422	1.7

POSITION ELEMENTARY STATISTICS FOR DIFFERENCES

OBSERVED VS TSC PREDICTED L_{10}

Position	Average Difference $\bar{d}$	Std. Dev. of Differences	t-Statistic for $\bar{d} = 0$	Degrees of Freedom	$\bar{d} = 0$? 95% Confidence
R1	-0.7	3.1	1.04	20	yes
R2	0.6	3.0	0.93	22	yes
S1	-4.5	4.6	4.43	20	no
S2	-5.1	2.9	8.02	20	no
S3	-13.9	6.2	8.59	14	no
C1	-2.2	2.2	3.94	15	no
C2	-2.2	3.4	2.86	19	no
C3	-1.8	3.0	2.84	22	no
C4	-5.0	2.8	8.46	22	no
A1	1.8	1.6	5.79	25	no
A2	-10.5	1.2	35.44	16	no
A3	-4.2	1.8	8.66	12	no
A4	-7.1	3.4	4.13	3	no
A5	-7.0	2.2	15.21	22	no
A6	-4.9	2.1	4.62	3	no
A7	-3.5	2.1	7.45	19	no
A8	-4.5	2.0	9.59	17	no
A9	1.4	2.4	3.00	25	no
A10	1.6	1.0	6.52	18	no
A11	-6.1	3.3	6.10	10	no
A12	-8.8	1.8	21.24	18	no

POSITION ELEMENTARY STATISTICS FOR DIFFERENCES

OBSERVED VS TSC PREDICTED L_{10}

Position	Average Difference $\bar{d}$	Std. Dev. of Differences	t-Statistic for $\bar{d} = 0$	Degrees of Freedom	$\bar{d} = 0$? 95% Confidence
B1	-2.8	1.2	11.78	23	no
B2	-7.3	1.8	19.46	23	no
B3	-18.2	2.9	31.14	23	no
N1	-2.9	2.3	5.07	15	no
N2	-0.5	2.6	0.83	15	yes
N4	0.81	1.6	2.44	21	no
N5	-1.6	5.9	0.90	10	yes
N8	-4.6	6.3	2.65	12	no

POSITION LINEAR REGRESSION BETWEEN

OBSERVED AND TSC PREDICTED L_{10}

Position	Regression Coefficient	Regression Coeff. = + 1?	Intercept	F-test	Degrees of Freedom	Correlation	Std. Error of Estimate
R1	0.619	no	18.912	157.8	19	0.945	1.6
R2	0.621	no	20.013	217.9	21	0.955	1.4
S1	0.443	no	33.801	50.0	19	0.851	2.1
S2	0.635	no	20.666	135.0	19	0.936	1.6
S3	0.373	no	27.628	9.4	13	0.649	3.7
C1	-0.048	no	75.876	0.1*	14	-0.084	1.1
C2	0.313	yes*	47.953	0.4*	18	0.153	3.3
C3	-0.331	no	91.645	1.0*	21	-0.214	2.3
C4	-0.296	no	82.563	0.7*	21	-0.183	2.2
A1	0.809	yes	16.432	22.0	24	0.691	1.6
A2	0.906	yes	-3.733	20.8	15	0.762	1.3
Å3	0.197	no	48.917	0.3*	11	0.168	1.5
A4	-1.018	yes*	124.304	0.7*	2	-0.513	2.7
A5	0.733	yes	13.617	18.1	21	0.681	2.1
A6	1.066	yes*	-9.690	1.5*	2	0.657	2.6

*The linear regression fails the F-test at the 95% confidence level. The regression is not valid.

POSITION LINEAR REGRESSION BETWEEN

OBSERVED AND TSC PREDICTED L_{10}

Position	Regression Coefficient	Regression Coeff. = + 1?	Intercept	F-test	Degrees of Freedom	Correlation	Std. Error of Estimate
A7	0.179	no	52.340	1.4*	18	0.265	1.3
A8	0.414	yes*	34.253	2.0*	16	0.331	1.8
A9	0.401	no	38.976	5.7	24	0.438	2.0
A10	0.683	no	21.326	41.8	17	0.843	0.9
A11	0.045	no	67.039	0.0*	9	0.041	2.5
A12	0.132	no	50.224	0.3*	17	0.141	1.4
B1	0.824	yes	10.848	55.9	22	0.847	1.1
B2	0.416	no	36.287	6.9	22	0.489	1.5
B3	-0.140	no	62.999	0.4*	22	-0.131	2.0
N1	0.875	yes	5.966	3.7	14	0.458	2.4
N2	1.267	yes	-17.439	7.2	14	0.584	2.6
N4	0.998	yes	0.928	14.5	20	0.648	1.6
N5	0.154	no	46.614	2.1*	9	0.431	2.2
N8	0.101	no	48.861	6.0	11	0.593	1.0

*The linear regression fails the F-test at the 95% confidence level. The regression is not valid.

STEP-WISE REGRESSION BY SITE BETWEEN

OBSERVED AND TSC PREDICTED L_{10}

Site	Significant Variable	Partial Regression Coefficient	t-Statistic of Variable	Partial Correlation Coefficient	Intercept	F-test	Degrees of Freedom	Multiple Correlation Coefficient	Standard Error of Estimate
R12	Truck Volume	-0.05603	-6.05	-0.642	2.83687	36.2	2,41	0.799	1.9
	Total Volume	-0.00073	-2.47	-0.262					
S123	Truck Volume	-0.10427	-10.97	-0.590	7.84599	120.7	3,53	0.934	2.2
	Distance	-0.11292	-12.61	-0.621					
	Auto/Truck	0.00222	2.54	0.136					
C1234	Truck Volume	-0.01679	-8.08	-0.595	3.89126	35.7	3,78	0.760	2.1
	Distance	-0.00469	-5.40	-0.399					
	Truck/Auto	0.52396	3.64	0.270					
A1234	Distance	-0.01183	-3.54	-0.407	3.94032	9.4	2,57	0.498	4.8
	Truck Volume	-0.01986	-2.67	-0.307					
A5678	Distance	0.00368	3.72	0.403	-4.59749	12.0	2,62	0.529	2.2
	Total Volume	-0.00309	-3.38	-0.366					

STEP-WISE REGRESSION BY SITE BETWEEN

OBSERVED AND TSC PREDICTED L_{10}

Site	Significant Variable	Partial Regression Coefficient	t-Statistic of Variable	Partial Correlation Coefficient	Intercept	F-test	Degrees of Freedom	Multiple Correlation Coefficient	Standard Error of Estimate
A9101112	Distance	-0.01592	-16.73	-0.835	6.57787	170.3	2,72	0.909	2.2
	Truck Volume	-0.01404	-4.99	-0.249					
B123	Distance	-0.04517	-13.79	-0.830	-26.20389	77.3	3,44	0.917	1.1
	Truck Speed	0.53210	4.64	0.296					
	Truck Volume	-0.00404	-2.71	-0.173					
N124	Distance	0.00539	4.77	0.518	11.87212	17.7	2,51	0.640	2.0
	Truck Speed	-0.34045	-2.86	-0.311					
N58	Truck Volume	-0.12554	-4.26	-0.539	-1.55901	27.1	2,21	0.849	3.4
	Auto/Truck	0.00421	3.71	0.470					

OBSERVED VS. MICHIGAN PREDICTED L_{10}

SITE ELEMENTARY STATISTICS FOR DIFFERENCES

OBSERVED VS MICHIGAN PREDICTED L_{10}

Site	Average Difference $\bar{d}$	Std. Dev. of Differences	t-Statistic for $\bar{d} = 0$	Degrees of Freedom	$\bar{d} = 0$? 95% Confidence
R12	-0.3	3.2	0.57	43	yes
S123	-3.9	4.5	6.49	56	no
C1234	2.1	4.3	4.51	81	no
A1234	5.6	4.8	9.19	59	no
A5678	2.8	3.3	6.99	64	no
A9101112	2.1	2.5	7.17	74	no
B123	0.8	2.3	2.30	47	no
N124	-0.8	2.8	2.06	53	no
N58	3.5	5.2	3.32	23	no

SITE LINEAR REGRESSION BETWEEN

OBSERVED AND MICHIGAN PREDICTED L_{10}

Site	Regression Coefficient	Regression Coeff. = +1?	Intercept	F-test	Degrees of Freedom	Correlation	Std. Error of Estimate
R12	0.620	no	19.367	204.3	42	0.911	1.9
S123	0.730	no	13.727	115.9	55	0.823	4.0
C1234	0.513	no	34.214	107.9	80	0.758	2.9
A1234	0.810	no	17.616	175.0	58	0.867	4.4
A5678	0.579	no	29.343	270.2	63	0.900	1.8
A9101112	0.563	no	28.599	63.2	73	0.681	2.1
B123	0.907	yes	7.305	114.9	46	0.845	2.3
N124	0.711	no	17.715	113.8	52	0.828	2.4
N58	0.162	no	46.751	9.0	22	0.538	1.5

POSITION ELEMENTARY STATISTICS FOR DIFFERENCES

OBSERVED VS MICHIGAN PREDICTED L_{10}

Position	Average Difference $\bar{d}$	Std. Dev. of Differences	t-Statistic for $\bar{d} = 0$	Degrees of Freedom	$\bar{d} = 0$? 95% Confidence
R1	-0.9	3.5	1.22	20	yes
R2	0.3	2.9	0.54	22	yes
S1	-3.5	3.2	4.96	20	no
S2	-2.2	2.4	4.19	20	no
S3	-6.9	6.7	4.00	14	no
C1	-2.7	2.4	4.50	15	no
C2	0.8	3.5	0.96	19	yes
C3	4.7	3.4	6.49	22	no
C4	4.2	3.4	5.87	22	no
A1	6.1	2.0	15.75	25	no
A2	0.2	2.0	0.46	16	yes
A3	12.2	2.1	21.40	12	no
A4	4.2	3.9	2.15	3	yes
A5	-0.1	2.2	0.20	22	yes
A6	0.7	1.9	0.70	3	yes
A7	4.1	2.2	8.42	19	no
A8	5.6	2.2	10.81	17	no
A9	1.1	2.7	2.13	25	no
A10	2.7	1.0	11.30	18	no
A11	3.4	3.9	2.95	10	no
A12	2.0	1.9	4.57	18	no

POSITION ELEMENTARY STATISTICS FOR DIFFERENCES

OBSERVED VS MICHIGAN PREDICTED L_{10}

Position	Average Difference $\bar{d}$	Std. Dev. of Differences	t-Statistic for $\bar{d} = 0$	Degrees of Freedom	$\bar{d} = 0$? 95% Confidence
B1	1.8	1.8	5.11	23	no
B2	-0.3	2.4	0.60	23	yes
B3	-9.0	3.5	12.78	23	no
N1	-1.4	2.4	2.33	15	no
N2	-2.7	2.7	4.01	15	no
N4	1.1	1.8	2.79	21	no
N5	1.7	4.7	1.19	10	yes
N8	5.1	5.3	3.48	12	no

POSITION LINEAR REGRESSION BETWEEN

OBSERVED AND MICHIGAN PREDICTED L_{10}

Position	Regression Coefficient	Regression Coeff. = + 1?	Intercept	F-test	Degrees of Freedom	Correlation	Std. Error of Estimate
R1	0.600	no	19.740	70.0	19	0.887	2.2
R2	0.639	no	18.940	185.8	21	0.948	1.5
S1	0.555	no	26.608	124.3	19	0.931	1.4
S2	0.674	no	19.865	312.8	19	0.971	1.1
S3	0.346	no	31.782	8.9	13	0.638	3.8
C1	0.005	no	71.833	0.0*	14	0.011	1.1
C2	0.288	yes*	50.646	0.6*	18	0.183	3.3
C3	-0.227	no	82.881	0.9*	21	-0.204	2.3
C4	-0.149	no	71.241	0.5*	21	-0.154	2.3
A1	0.538	no	39.551	20.9	24	0.682	1.6
A2	0.458	no	33.572	3.9*	15	0.452	1.7
A3	0.076	no	58.231	0.1*	11	0.082	1.5
A4	-0.852	no	103.857	1.1*	2	-0.590	2.6
A5	0.666	no	23.382	22.4	21	0.719	2.0
A6	1.148	yes*	-9.131	2.3*	2	0.734	2.3

*The linear regression fails the F-test at the 95% confidence level. The regression is not valid.

POSITION LINEAR REGRESSION BETWEEN

OBSERVED AND MICHIGAN PREDICTED L_{10}

Position	Regression Coefficient	Regression Coeff. = + 1?	Intercept	F-test	Degrees of Freedom	Correlation	Std. Error of Estimate
A7	0.312	no	45.750	4.0*	18	0.427	1.5
A8	0.328	no	43.312	2.0*	16	0.332	1.8
A9	0.357	no	41.588	9.2	24	0.525	1.9
A10	0.650	no	24.150	63.4	17	0.888	0.7
A11	-0.057	no	67.380	0.0*	9	0.070	2.5
A12	0.196	no	47.975	1.3*	17	0.262	1.3
B1	0.567	no	33.507	52.8	22	0.840	1.2
B2	0.302	no	46.990	6.7	22	0.483	1.5
B3	-0.077	no	57.550	0.2	22	-0.104	2.0
N1	0.647	yes*	23.098	3.2*	14	0.430	2.4
N2	0.830	yes	8.357	5.0	14	0.514	2.8
N4	0.589	no	25.273	15.4	20	0.659	1.6
N5	0.241	no	42.446	4.5*	9	0.575	2.0
N8	0.108	no	49.521	4.3*	11	0.528	1.1

*The linear regression fails the F-test at the 95% confidence level. The regression is not valid.

STEP-WISE REGRESSION BY SITE BETWEEN

OBSERVED AND MICHIGAN PREDICTED L_{10}

Site	Significant Variable	Partial Regression Coefficient	t-Statistic of Variable	Partial Correlation Coefficient	Intercept	F-test	Degrees of Freedom	Multiple Correlation Coefficient	Standard Error of Estimate
R12	Total Volume	-0.00156	-4.19	-0.543	2.03501	17.6	1,42	0.543	2.7
S123	Truck Volume	-0.12266	-6.95	-0.697*	-2.02038	33.5	3,53	0.809	2.7
	Height	0.28421	4.63	0.408*					
	Truck %	0.86926	2.39	-0.451*					
C1234	Truck Volume	-0.02121	-8.07	-0.555	5.16611	44.6	3,78	0.796	2.7
	Distance	0.00764	6.96	0.480					
	Truck/Auto	0.59897	3.29	0.228					
A1234	Total Volume	-0.00806	-4.82	-0.536	10.42150	23.3	1,58	0.536	4.1
A5678	Distance	0.00864	9.63	0.735	1.85296	55.2	2,62	0.800	2.0
	Total Volume	-0.00392	-4.54	-0.361					

*These are not partial correlation coefficients. They are simple regression coefficients between the variable and the differences.

STEP-WISE REGRESSION BY SITE BETWEEN

OBSERVED AND MICHIGAN PREDICTED L_{10}

Site	Significant Variable	Partial Regression Coefficient	t-Statistic of Variable	Partial Correlation Coefficient	Intercept	F-test	Degrees of Freedom	Multiple Correlation Coefficient	Standard Error of Estimate
A9101112	Truck Volume	-0.01821	-7.17	-0.651	5.79443	26.3	2,72	0.650	1.9
	Distance	0.00189	2.19	0.199					
B123	Truck Volume	-0.00913	-6.14	-0.463	-31.75734	51.1	3,44	0.882	1.1
	Distance	-0.02117	-6.47	-0.461					
	Truck Speed	-0.69697	6.10	0.459					
N124	Total Volume	-0.00129	-4.41	-0.462	-1.15973	20.8	2,51	0.670	2.1
	Distance	0.00477	-4.10	0.430					
N58	Truck Volume	-0.10060	-4.27	-0.516	2.54739	30.2	3,20	0.905	2.4
	Distance	0.01756	4.57	0.439					
	Auto Volume	-0.00918	-3.53	-0.427					

TSC PREDICTED VS. MICHIGAN PREDICTED L_{10}

SITE ELEMENTARY STATISTICS FOR DIFFERENCES

TSC PREDICTED VS MICHIGAN PREDICTED L_{10}

Site	Average Difference $\bar{d}$	Std. Dev. of Differences	t-Statistic for $\bar{d} = 0$	Degrees of Freedom	$\bar{d} = 0$? 95% Confidence
R12	-0.3	1.9	0.92	45	yes
S123	3.4	3.4	8.34	68	no
C1234	4.5	3.8	11.40	91	no
A1234	10.3	4.3	24.21	102	no
A5678	7.7	1.9	40.42	102	no
A9101112	5.5	5.2	10.89	102	no
B123	7.0	2.0	28.92	71	no
N124	-0.1	1.7	0.56	71	yes
N58	6.5	4.0	8.95	29	no

SITE LINEAR REGRESSION BETWEEN

TSC PREDICTED AND MICHIGAN PREDICTED L_{10}

Site	Regression Coefficient	Regression Coeff. = + 1?	Intercept	F-test	Degrees of Freedom	Correlation	Std. Error of Estimate
R12	1.000	yes	-0.271	544.3	44	0.962	2.0
S123	0.821	no	15.024	286.2	67	0.900	3.1
C1234	0.449	no	41.254	1765.9	90	0.975	0.7
A1234	0.544	no	37.671	1077.5	101	0.956	1.5
A5678	0.760	no	22.777	1647.8	101	0.971	1.2
A9101112	-0.051	no	68.769	0.3*	101	-0.051	3.6
B123	0.633	no	31.700	7016.4	70	0.995	0.4
N124	1.018	yes	-1.299	598.4	70	0.946	1.7
N58	0.836	yes	15.120	46.8	28	0.791	3.9

*The linear regression fails the F-test at the 95% confidence level. The regression is not valid.

POSITION ELEMENTARY STATISTICS FOR DIFFERENCES

TSC PREDICTED VS MICHIGAN PREDICTED L_{10}

Position	Average Difference $\bar{d}$	Std. Dev. of Differences	t-Statistic for $\bar{d} = 0$	Degrees of Freedom	$\bar{d} = 0$? 95% Confidence
R1	-0.3	2.0	0.63	22	yes
R2	-0.3	1.9	0.67	22	yes
S1	0.8	2.9	1.27	22	yes
S2	2.8	1.8	7.67	22	no
S3	6.7	2.3	13.86	22	no
C1	-0.6	0.7	4.61	22	no
C2	3.0	0.5	30.23	22	no
C3	6.5	0.6	52.42	22	no
C4	9.2	0.9	46.85	22	no
A1	4.3	0.9	24.96	28	no
A2	10.9	0.9	54.17	20	no
A3	16.0	0.6	132.37	22	no
A4	11.3	0.5	117.84	29	no
A5	6.9	0.5	71.29	28	no
A6	5.2	0.4	54.41	20	no
A7	7.7	0.7	52.21	22	no
A8	10.2	0.8	66.93	29	no
A9	-0.2	1.0	1.34	28	yes
A10	1.2	0.5	11.64	20	no
A11	9.6	0.6	74.11	22	no
A12	11.0	0.9	66.71	29	no

POSITION ELEMENTARY STATISTICS FOR DIFFERENCES

TSC PREDICTED VS MICHIGAN PREDICTED L_{10}

Position	Average Difference $\bar{d}$	Std. Dev. of Differences	t-Statistic for $\bar{d} = 0$	Degrees of Freedom	$\bar{d} = 0$? 95% Confidence
B1	4.7	1.0	22.35	23	no
B2	7.1	0.7	47.07	23	no
B3	9.1	0.9	52.47	23	no
N1	1.5	0.6	12.05	23	no
N2	-2.1	0.6	15.76	23	no
N4	0.2	1.0	0.96	23	yes
N5	3.3	2.4	5.21	14	no
N8	9.7	2.1	17.60	14	no

POSITION LINEAR REGRESSION BETWEEN

TSC PREDICTED AND MICHIGAN PREDICTED L_{10}

Position	Regression Coefficient	Regression Coeff. = + 1?	Intercept	F-test	Degrees of Freedom	Correlation	Std. Error of Estimate
A7	0.838	no	17.429	171.1	21	0.944	0.6
A8	0.756	no	23.761	148.5	28	0.917	0.7
A9	0.739	no	16.215	687.6	27	0.981	0.5
A10	0.898	no	7.431	356.4	19	0.974	0.4
A11	0.771	no	23.296	1555.0	21	0.993	0.2
A12	0.693	no	28.457	149.6	28	0.918	0.6
B1	0.686	no	27.622	1009.1	22	0.989	0.3
B2	0.731	no	25.226	2883.9	22	0.996	0.2
B3	0.687	no	28.429	1491.3	22	0.993	0.2
N1	0.724	no	20.771	339.7	22	0.969	0.4
N2	0.699	no	19.522	499.3	22	0.979	0.3
N4	0.564	no	25.667	369.0	22	0.971	0.3
N5	1.029	yes	1.624	71.2	13	0.920	2.5
N8	1.128	yes	3.255	122.7	13	0.951	2.1

POSITION LINEAR REGRESSION BETWEEN

TSC PREDICTED AND MICHIGAN PREDICTED L_{10}

Position	Regression Coefficient	Regression Coeff. = + 1?	Intercept	F-test	Degrees of Freedom	Correlation	Std. Error of Estimate
R1	1.002	yes	-0.380	250.8	21	0.961	2.0
R2	0.997	yes	-0.161	269.8	21	0.963	2.0
S1	1.048	yes	-2.545	104.4	21	0.912	3.0
S2	0.980	yes	4.107	254.8	21	0.961	1.8
S3	0.924	yes	11.133	199.0	21	0.951	2.3
C1	0.786	no	15.455	222.8	21	0.956	0.5
C2	0.768	no	19.131	7874.5	21	0.999	0.1
C3	0.720	no	24.275	7103.3	21	0.999	0.1
C4	0.595	no	32.798	1892.5	21	0.994	0.1
A1	0.679	no	27.571	911.2	27	0.986	0.3
A2	0.726	no	27.684	66.2	19	0.881	0.8
A3	0.740	no	29.278	1708.9	21	0.994	0.2
A4	0.836	no	20.153	497.8	28	0.973	0.4
A5	0.850	no	17.403	1685.3	27	0.992	0.3
A6	0.886	no	12.758	370.8	19	0.975	0.4

STEP-WISE REGRESSION BY SITE BETWEEN

TSC PREDICTED AND MICHIGAN PREDICTED L_{10}

Site	Significant Variable	Partial Regression Coefficient	t-Statistic of Variable	Partial Correlation Coefficient	Intercept	F-test	Degrees of Freedom	Mulitple Correlation Coefficient	Standard Error of Estimate
R12	Truck %	23.67738	6.46	0.799*	2.57219	92.1	2,43	0.900	0.9
	Truck/Auto	-2153.82544	-6.26	0.792*					
S123	Distance	0.11015	8.83	0.683*					
	Auto/Truck	-0.00295	-4.32	-0.430*					
	Height	0.28880	4.04	-0.493*					
	Truck %	0.57504	3.95	0.417*					
C1234	Distance	0.01296	24.59	0.925	1.07353	309.3	2.89	0.935	1.4
	Truck Volume	-0.00476	-3.67	-0.138					
A1234	Distance	0.00778	6.27	0.512	3.78814	25.5	2,100	0.581	3.6
	Truck %	0.07906	3.77	0.308					
A5678	Distance	0.00589	18.49	0.850	7.23185	125.6	3.99	0.890	0.9
	Truck Volume	-0.00489	-4.93	-0.227					
	Truck %	-0.01676	-3.19	-0.147					

*These are not partial correlation coefficients. They are simple regression coefficients between the variable and the differences.

STEP-WISE REGRESSION BY SITE BETWEEN

TSC PREDICTED AND MICHIGAN PREDICTED L_{10}

Site	Significant Variable	Partial Regression Coefficient	t-Statistic of Variable	Partial Correlation Coefficient	Intercept	F-test	Degrees of Freedom	Multiple Correlation Coefficient	Standard Error of Estimate
A9101112	Distance	0.01793	24.29	0.929	0.09628	295.4	2,100	0.925	2.0
	Total Volume	-0.00204	-3.16	-0.121					
B123	Distance	0.01431	25.94	0.882	5.66497	265.9	3,68	0.960	0.6
	Truck Volume	-0.00628	-10.59	-0.361					
	Auto/Truck	-0.19181	-4.33	-0.148					
N124	Truck Volume	-0.00735	-3.12	-0.350	1.71164	9.7	1,70	0.350	1.6
N58	Distance	0.02523	15.18	0.824	-0.89138	104.5	3,26	0.961	1.2
	Auto/Truck	-0.00338	-9.11	-0.535					
	Total Volume	-0.00323	-3.42	-0.201					

A P P E N D I X D

STEP-WISE REGRESSION

Step-wise Regression

Step-wise regression is used to select independent variables in the order of importance and to enter them in a multiple linear regression model. The criterion on importance is based on the reduction of sum of squares, and the independent variable which reduces the largest amount in a given step is entered in the regression. In each step of regression i = 1, 2, ---, q, where q is the number of independent variables, the abbreviated Doolittle method is used to calculate the following statistics:

The independent variable entering in the regression is selected, first, by computing the amount of reduction of sum of squares by each variable:

$$C_j = \frac{a_{jy}^2}{a_{jj}} \qquad (1)$$

where a_{jj} is initially an element in the sums of cross-products of deviation matrix which will be modified in successive steps.

j = 1, 2, ---, q are independent variables ($j \neq$ variables deleted and variables entered prior to i-th step)

y = dependent variable

and, second, by finding the largest value of C_j.

Set $S_i = C_j$ to indicate the sum of squares that will be reduced in i-th step.

The proportion of S_i to the total is obtained by

$$p = \frac{S_i}{D} \qquad (2)$$

where $D = \sum_{j=1}^{n} \left(y_j - \bar{y}\right)^2$

n = number of observations

The cumulative sum of squares reduced is obtained by

$$S_{cum} = S_{cum} + S_i \qquad (3)$$

and the cumulative proportion reduced as

$$P_{cum} = P_{cum} + p \qquad (4)$$

F value based on the incremental sum of squares reduced is

$$F' = \frac{S_i}{\left(D - S_{cum}\right) / \left(n-i-1\right)} \qquad (5)$$

Multiple correlation coefficient is computed by

$$R = \sqrt{P_{cum}} \qquad (6)$$

and the adjusted multiple correlation coefficient for degrees of freedom by

$$\bar{R}_c = \sqrt{1 - \left(1 - R^2\right)\left(\frac{n-1}{n-i}\right)} \qquad (7)$$

F value for analysis of variance is given by

$$F = \frac{S_{cum} / i}{\left(D - S_{cum}\right) / \left(n-i-1\right)} \qquad (8)$$

Standard error of estimate is obtained by the use of the formula

$$s_{y.12\ldots i} = \sqrt{\frac{D - S_{cum}}{n-i-1}} \qquad (9)$$

and the adjusted standard error of estimate for degree of freedom by

$$s'_{y.12\ldots i} = s_{y.12\ldots i}\sqrt{\frac{n-1}{n-i}} \qquad (10)$$

Compute:

$$a_{jj} = a_{jj} + \frac{a_{ij}^2}{a_{ii}} \qquad (11)$$

where i = variable entered in i-th step

$j = V_1, V_2, \cdots, V_{i-1}$ are the variables entered in the regression prior to i-th step

$$g_{ik} = \frac{a_{ik}}{a_{ii}} \qquad (12)$$

where k = 1, 2, ---, m are variables including y (k ≠ variables deleted and the variable entered in i-th step)

Regression coefficients are computed by

$$b_i = g_{iy}$$

$$b_{i-1} = g_{(i-1)y} - b_i\, g_{(i-1)i} \qquad (13)$$

$$b_{i-2} = g_{(i-2)y} - b_i\, g_{(i-2)i} - b_{i-1}\, g_{(i-2)(i-1)}$$

etc.

and the value of intercept as

$$b_0 = \bar{y} - \sum_{j=1}^{k} b_j \bar{x}_j \qquad (14)$$

where k = number of independent variables in the regression

Standard errors of regression coefficients are given by

$$s_{b_j} = \sqrt{a_{jj}}\, s_{y.12\ldots i} \qquad (15)$$

where $j = V_1, V_2, \ldots, V_i$ are variables in the regression

and t-values as

$$t_j = \frac{b_j}{s_{b_j}} \qquad (16)$$

and standardized regression coefficients, beta weights, as

$$\beta_j = b_j \frac{s_j}{s_y} \qquad (17)$$

where s_j and s_y are standard deviations.

Perform the reduction to eliminate the variable entered in i-th step:

$$a_{jk} = a_{jk} - a_{ji}\, g_{ik} \qquad (18)$$

where i = variable entered in i-th step

j = 1, 2, ..., m (j ≠ variables deleted and variables in the regression)

k = 1, 2, ..., m (k ≠ variables deleted and the variable entered in i-th step)

$$a_{ji} = \frac{a_{ji}}{-a_{ii}} \qquad (19)$$

$$a_{ii} = \frac{1}{a_{ii}} \qquad (20)$$

Reference:

Bennett, Carl A. and Franklin, Norman L.: Statistical Analysis in Chemistry and the Chemical Industry, John Wiley & Sons, New York, 1954, Appendix 6A.

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